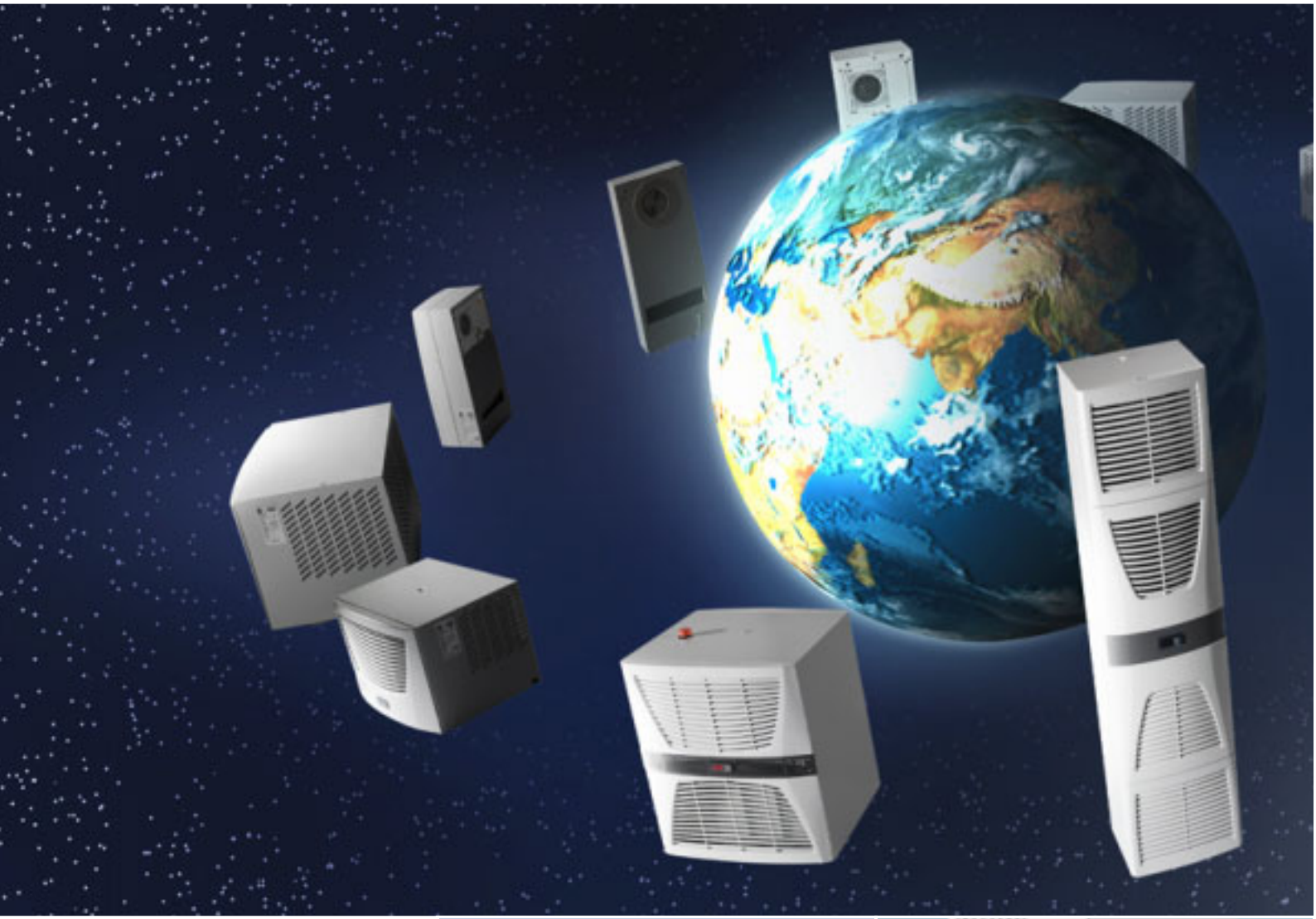
# Rittal SK –
# **System Climate Control**

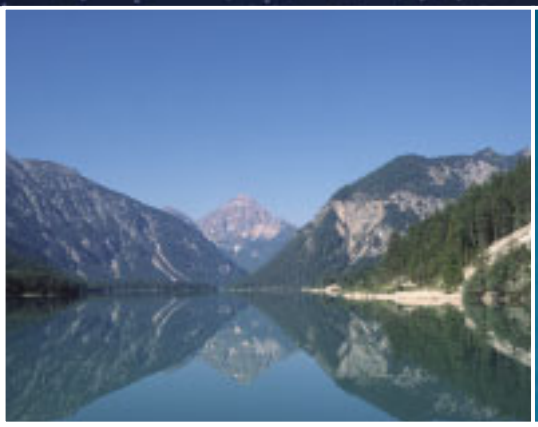
We create the climate for productivity

FRIEDHELM LOH GROUP

RITTAL®

# Global leaders





## Energy-efficient and eco-friendly

Rittal has set signals worldwide, thanks to its research and development work with **ProOzone** cooling units.

The latest results of this pioneering work include:

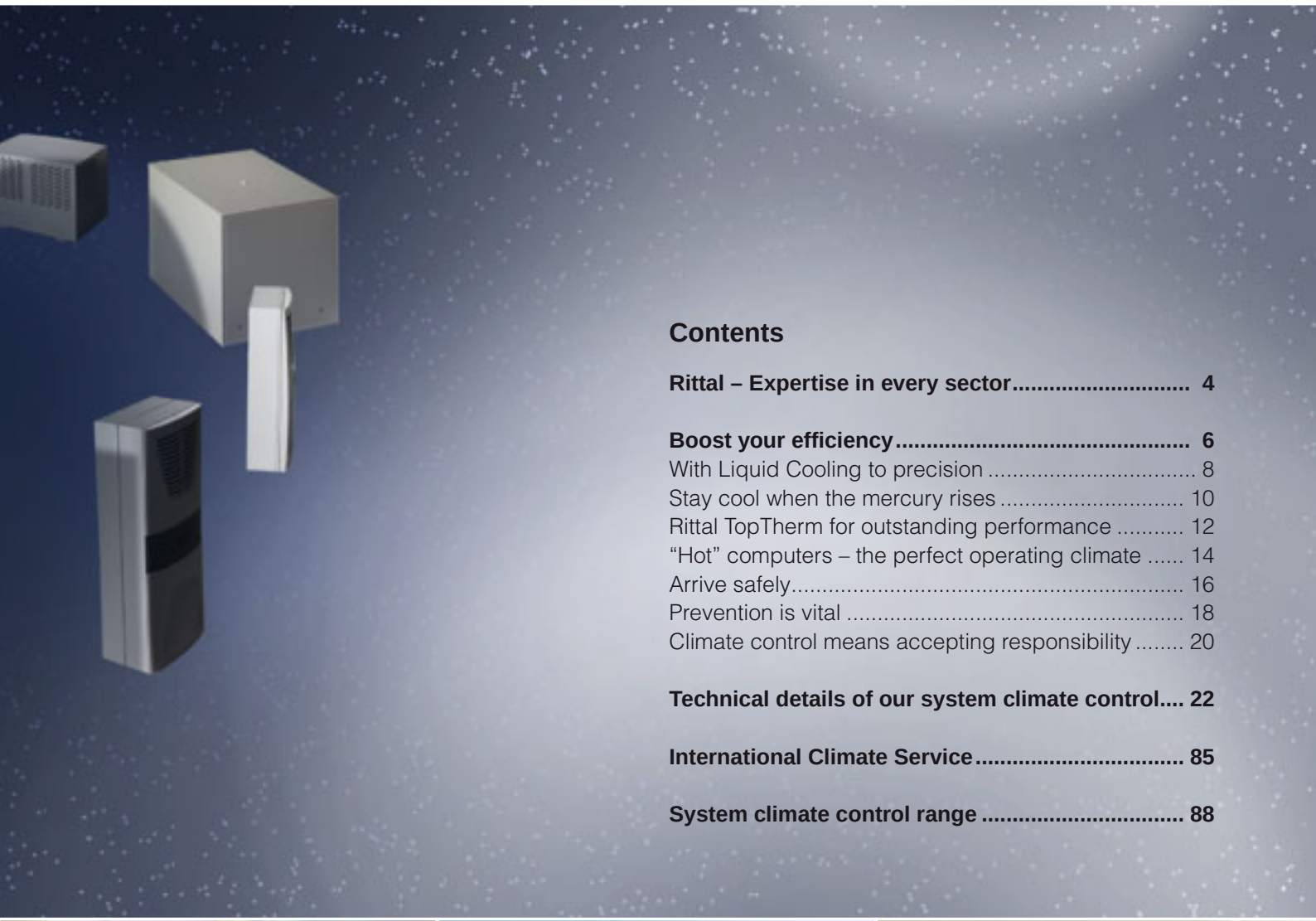
- **Nano** surface protection
- **Liquid Cooling** product range
- Coolants based on **$CO_2$**

## Faster and better with our system platform

- Identical system platform for cooling units and heat exchangers
- Identical mounting interfaces
- Flexible and cost-effective for a wide range of applications

There is a global demand for optimum cooling concepts for industry and IT. With this in mind, we offer comprehensive availability worldwide, coupled with identical quality standards for all our products and services. We supply perfection on the basis of international approvals and coordinated research and development work.

**Rittal system climate control: global – effective – future-oriented.**



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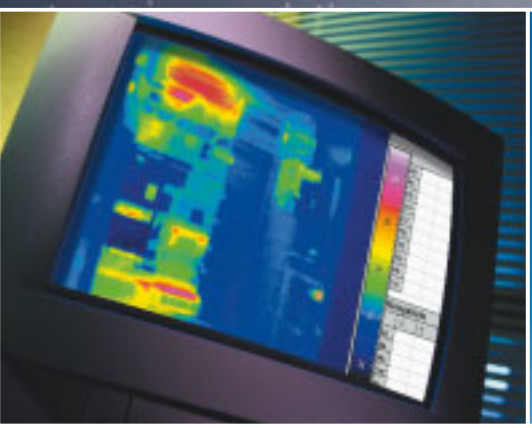


### Service governs success

- Project planning
- Thermal analyses with thermography and temperature measurements
- CFD analyses and flow models
- Tests in environmental testing laboratories

### Guaranteed quality

- High standard of quality
- Global availability
- International approvals
- Accredited in-house laboratories

### Production sites for short transportation distances

With this in mind, we produce climate control components in

- **Europe** (Rennerod, Germany and Valeggio, Italy)
- **North America** (Urbana, USA) and in
- **Asia** (Bangalore, India and Shanghai, China)

# Rittal – Expertise in every sector

Rittal has an in-depth understanding of the requirements in the various sectors. Whether plant manufacturing or aluminium production, the food industry or aviation, textiles manufacturing or tanker construction, mechanical engineering or medical technology – from industry to IT, Rittal has a climate control concept to suit.

**We are looking forward to our next challenge.**

### Rittal's global sector experience

- Mechanical engineering
- Machinery and plant manufacturing
- Automotive industry
- Conveyor systems
- Welding technology
- Wood and processing machines
- Iron, steel and mill equipment
- Printing and paper technology
- Office and information technology
- Food and packaging machinery
- Telecommunications
- Textile machinery
- Machine tool construction
- Transport technology
- Medical technology
- Communications technology
- Power engineering
- IT sector

# Boost your efficiency

### With liquid cooling to precision

Stable operating conditions are crucial for high clock speeds and consistent quality.

**Rittal recooling systems** supply precise cooling medium temperatures and volume flows for innovative welding and laser techniques.

### Stay cool when the mercury rises

The control systems remain unaffected by extreme heat and dust.

Even high heat losses are reliably dissipated via **air/water heat exchangers** in conjunction with a recooling system.

### Rittal TopTherm for outstanding performance

Spray-finishing plants create ambient conditions that are often highly critical for controllers, due to the associated heat and humidity.

These highly varied requirements are met by a single product range: **Rittal TopTherm cooling units.**

Throughout all sectors of modern companies, efficiency is closely related to climate control. This applies equally to the cooling of IT systems and production control, regardless of whether the ambient conditions are clean or polluted with heat and dust. Rittal offers a range of **standardised climate control concepts to meet even extreme requirements.**

### “Hot” computers – the perfect operating climate!

Heat and noise emissions from a high-performance server in the middle of the office?

You don't have to put up with this! Because **Rittal Liquid Cooling concepts** offer new framework conditions for your IT.

### Arrive safely

Transport, data and energy are the lifeblood of an innovative industrial company and necessitate reliable flows and fast delivery times.

Rittal offers optimum prerequisites with CS Outdoor systems. Enclosure, climate control and security technology, configured precisely to your specifications.

### Prevention is vital

Correct management of the temperature balance is essential. This is one of numerous analogies between humans and technology.

**Air/air heat exchangers or fan-and-filter units** ensure constant cooling of modern medical analysis equipment, laboratory, testing and production systems.

# With liquid cooling to precision

High clock speeds at outstanding quality, hot processes, cool control – this is the challenge posed by all robot welding systems. Particularly when using innovative laser techniques, precise cooling medium temperatures and volume flows are crucial for **stable operating conditions, speed and precision.**

**Rittal recooling systems – precise cooling of processes, machines and controllers.**

### A central position: Rittal recooling systems

- Operate with water, oil and other media.
- Immersion recooling systems cool heavily contaminated media.
- Integrated into the TS 8 Top enclosure system, the recooling system forms a design line with the control cabinets.

### Maximum opportunities with mini recooling systems

- Roof-mounted and wall-mounted
- Space-saving, compact design
- A design line with Rittal TopTherm cooling units and heat exchangers

### Innovative liquid cooling concepts

Rittal DCP Cold Plate, DCP CoolingUnit and DCP PanelCooling:

- Liquid-cooled mounting plates for direct cooling of power components and indirect cooling of the entire enclosure interior.
- A high protection category is preserved.

### Effective and central

Mini-recooling system, wall-mounted, for cooling a machining centre

- Compactly integrated into the control cabinet
- Cooling of the enclosures via air/water heat exchangers
- Separate cooling circuit for motor and process cooling

# Stay cool when the mercury rises

No problem! The nearby control system remains unaffected by red-hot steel tubing and metal dust. 3, 6 or 9 kW heat loss? Air/water heat exchangers in conjunction with a recooling system always provide **ideal operating temperatures for control and power electronics.** The enclosure protection category remains completely unaffected. This added-value for your applications is achieved thanks to the very latest TopTherm nano-technology, ideal for use in dusty environments. **Rittal's standardised system climate control for extreme conditions ensures targeted, efficient operation at all times.**

### Including machine and process cooling

- Operational reliability thanks to liquid cooling e.g. of high-frequency motor spindles and other drive technology.
- Precise material machining thanks to precise, constant temperatures of the cooling media.

### Dissipation of extremely high heat loads

- Air/water heat exchangers cool enclosures even at ambient temperatures of up to +70°C
- Connected to a cooling fluid circuit or a recooling system
- Simple wall mounting or roof mounting
- Virtually maintenance-free

### Dirty on the outside, clean on the inside – thanks to nano-technology

No dirt adheres to the ultra-thin, glass-like seal of the cooling membranes.

- Permanently stable cooling performance
- Significantly simplified cleaning
- Enhanced cost-efficiency and reduced servicing costs

# Rittal TopTherm for outstanding performance

Cleaning, phosphating, dipcoat-priming, spray-finishing, drying. A process chain with extreme variations in ambient conditions, which also applies to climate control of the controllers. Whether humidity, paint dust or drying heat – these **differing requirements are met by a single product range: Rittal TopTherm cooling units.**

### Our comprehensive range

- Climate controlled enclosures, climate control doors and side panels: Enclosure module and climate components are combined into one – no need for assembly.
- Roof-mounted cooling units: Fast assembly with roof frame, individual, targeted air routing inside and out.
- Wall-mounted cooling units: Effective air routing and flexible assembly options.
- Design variants: RiNano, stainless steel, NEMA 4x, with condensate management.

### Intelligent control and monitoring

- Basic or Comfort controller – the correct control and security electronics to suit your requirement profile.
- Master/slave function – the cooling output of several cooling units in a bayed enclosure suite is coordinated to boost efficiency.
- Remote monitoring – ensures availability and cuts costs.

### Rittal TopTherm cooling units define the future-oriented performance class

- Technology – a new dimension in convenience, reliability and flexibility
- Cooling output – efficient generation, targeted distribution
- Form follows function – aesthetics with a strong message

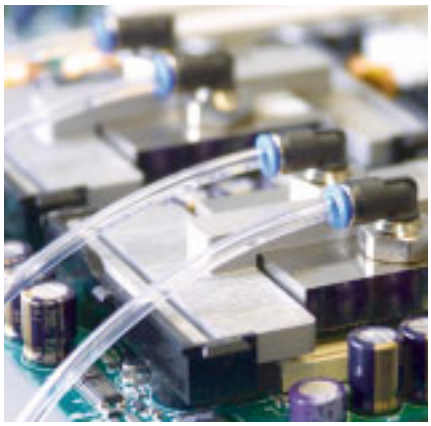
RIMATRIX5

# “Hot” computers – the perfect operating climate!

A high performance server in the data centre or in the middle of the office? Without putting additional thermal pressure on the air-conditioning system? Without the irritating noise of high-speed fan-and-filter units? All that can now be achieved very easily! Because Rittal Liquid Cooling concepts offer **new framework conditions for your IT infrastructures in terms of flexibility, safety and cost-efficiency.** Independently of the room situation, with almost zero heat and noise emissions, individual server CPUs and complete server units or electronic components receive direct, highly effective cooling. **Rittal system climate control – modular concepts tailored to your precise requirements.**

### From home offices to data centres

- Perfect IT cooling concepts to suit every application
- High Performance cooling – Liquid cooling systems for rack and component cooling
- Active, rack-based cooling with cooling units and rack-mounted recooling system
- Passive and active cooling using the ambient air



### Super cooling for super computers

- Efficient climate control solutions – even in the most confined spaces – achieved cost-effectively.
- The heat generation of 60 kW caused by the high computer performance of the CPUs is effectively dissipated with liquid-based CPU cooling.

# Arrive safely

Transport, power, communication and data flows – these are the life blood of today's innovative industrial society.

Reliable flows and fast delivery are the modern mantra. For this reason, ensuring the **maximum possible availability** via reliable open and closed-loop control processes is crucial, particularly in the outdoor sector.

Rittal creates the optimum prerequisites with CS Outdoor systems: **configured entirely to your requirements.**

### Outdoor climate control with the necessary performance

- Climate control units for CS Toptec, the stainless steel system enclosure based on TS 8.
- Heat exchangers or cooling units, optionally for internal, partial internal or external mounting – also with microcontrollers and heaters.

### From twin-walled enclosures to modular large enclosures

- Climate protection, corrosion resistance, EMC protection, mechanical protection from vandalism and earthquakes.
- Cleverly thought-out designs, high-quality materials, special production techniques and RiNano surface finishes ensure CS enclosures with perfect protection for your high-tech equipment.
- CS is tested to international standards such as: IEC, ETSI, Bellcore, Nema and UL.

### Complete system integration for extreme conditions

- Cooling – even to below the ambient temperature, heating to prevent critical condensation.
- Microcontrollers and sensors for comprehensive remote monitoring.
- Interior installation for your plug & play assembly.
- Emergency power supply – also with fuel cell.

LD 125.7cm CD-13.9cm

# Prevention is vital

There are many analogies between humans and technology. The quality of and interactions between each individual detail determine our mental and physical vitality.

**Correct management of the temperature balance is vital.**

The climate control of modern medical analysis equipment, as well as laboratory, testing and production systems, is equally important. The right climate ensures a high level of performance and eliminates risks! **Rittal system climate control ensures that your systems achieve reliable peak performances.**

### Special hygiene and safety requirements, solved with reliable Rittal products

- Nano-surface finishes on heat exchanger membranes and stainless steel enclosures.
- EMC fan-and-filter unit to prevent electromagnetic interference.
- Preserving high protection categories with heat dissipation via modern liquid cooling concepts.

### Cool efficiently using the ambient air

Even at the height of summer, there must be a difference between the external and internal temperatures.

- Fan-and-filter units operate efficiently in comparatively clean, cool ambient air.
- Air/air heat exchangers protect the enclosure interior from dust and aggressive ambient air via two separate air cycles.

### Assembly and maintenance are very simple

Cost minimisation is the result.

- Platform strategy – Identical mounting cut-outs for different heat exchanger performance classes.
- Super-fast clip-on mounting – Fast, secure attachment of the fan-and-filter unit is guaranteed.

# Climate control means accepting responsibility

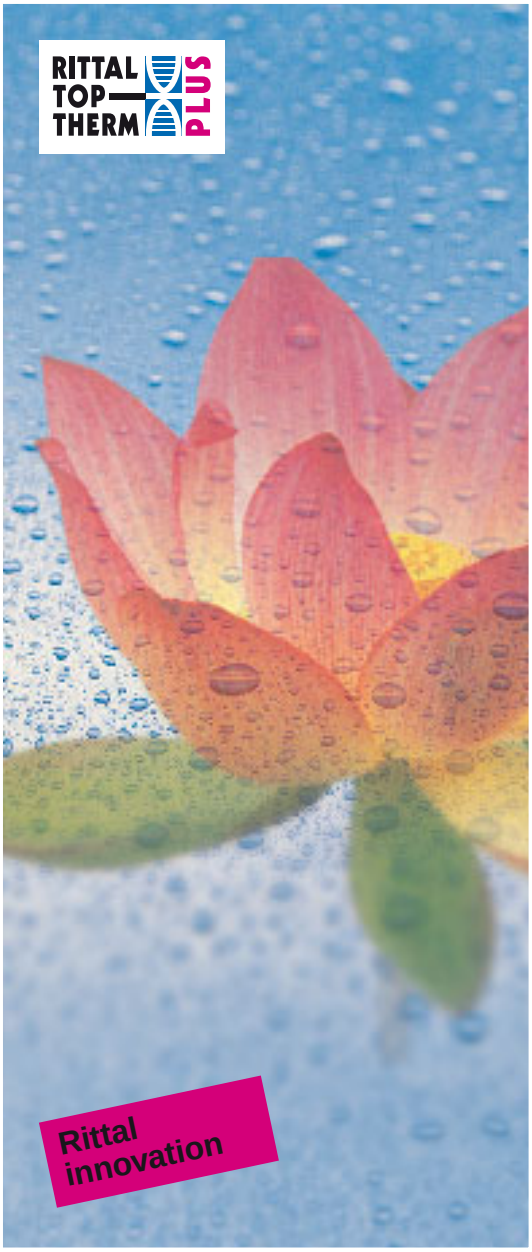
Everyone talks about the future, but Rittal helps shape it – and that includes the field of climate control. Development work focuses on sustainability and environmental protection, and Rittal has always set special standards in this field.

Pro Ozone, the symbol for eco-friendly cooling technology, has gained international renown since 1992. At that time, attention focussed on replacing the coolant CFC, which was blamed for destroying the ozone layer, a vitally important UV filter. Now, efforts are directed at the greenhouse effect. $CO_2$ is the coolant of the future. For Rittal, it is obvious that we need to act promptly to provide a functionally reliable yet powerful technology.

**We smoothe the way for reliable investments, a healthy environment, and enhanced competitiveness for our customers.**

For those who place their trust in Rittal, value-added comes as standard. What is more, Rittal is global trendsetter in the field of climate control.
Setting trends means understanding our customers. This is the pre-requisite for transforming our inventions into marketable innovations.

Three pioneering new features bear witness to this fact: Rittal TopTherm cooling units are now equipped **as standard with innovative RiNano coating and integral electronic condensate evaporation**, and **$CO_2$ as a refrigerant for cooling units** has achieved outstanding results in practical trials.




### $CO_2$ as the refrigerant of the future

Rittal underscores its **technological leadership in the field of $CO_2$ climate control.** Compared with $CO_2$, as a component of the atmosphere, the refrigerant R134a has a direct greenhouse effect that is 1300 times more powerful.

Rittal has achieved huge success with the use of $CO_2$ as a coolant. The first prototypes were unveiled back in 2005.
In 2006 Rittal launched a series of $CO_2$ cooling units that had undergone extensive practical trials.

### Electronic condensate evaporation

Any condensate incurred is effectively evaporated and doesn't need to be collected or dissipated.

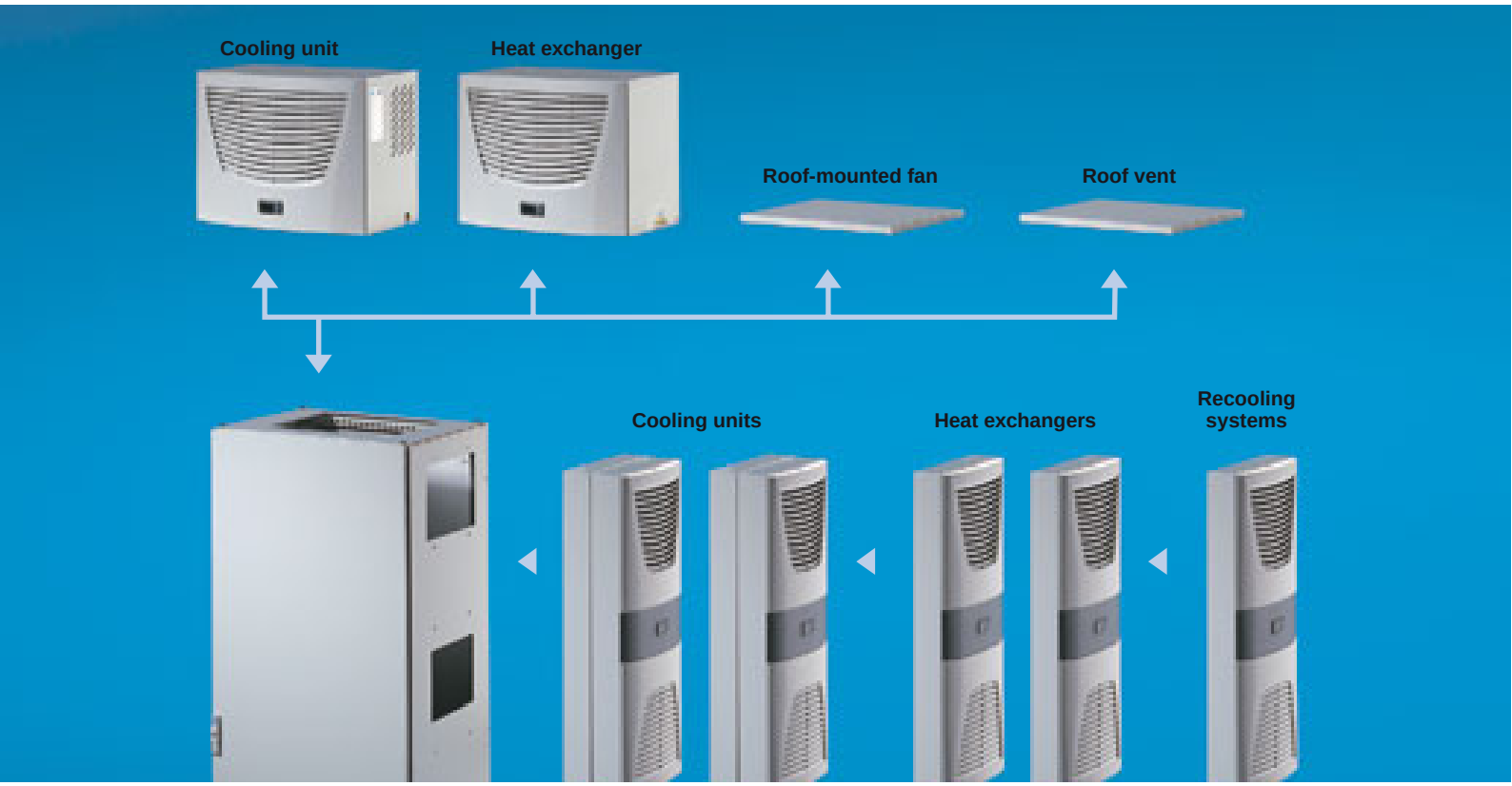
**Your value-added:**
- Enhanced safety – No dripping condensation
- Time savings – No need to empty condensate containers
- Cost benefits – No need to lay condensate tubing

### RiNano – taking its lead from nature

Following the example of the lotus flower, the ultra-thin, glass-like RiNano sealing of the heat exchanger membranes prevents dirt particles from adhering to the condenser.

**Your value-added:**
- Less maintenance, easier cleaning.
- The cooling output is maintained at a high level over the long term.

# Rittal platform strategy




**An enclosure interface for every cooling output**

The perfect, variable and simple union of enclosure and cooling unit: the climate control platform strategy. Cooling units, mini-recooling units (wall-mounted), heat exchangers and fans (roof-mounted) of different output categories may be used on one identical mounting interface. This means that the same control cabinet is easily adapted to the requirements of the climate zone and the ambient conditions of the installation site. Both the device type and the cooling output are easily varied.

# Technical details of our system climate control

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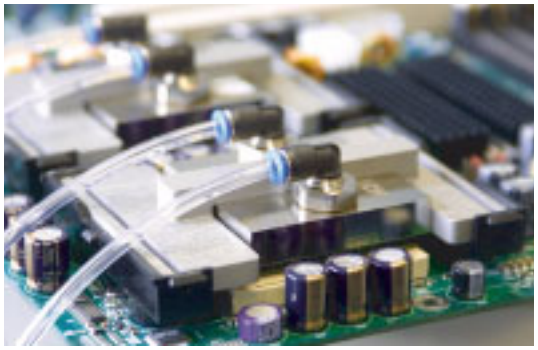

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# Basic principles of climate control components

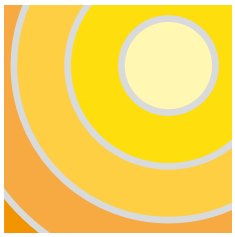


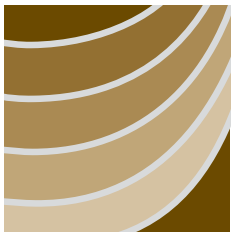
**Guide to selecting suitable units.**

As electronic components become ever smaller and are more densely packed in enclosures and electronic cases, systems are becoming increasingly sensitive to external factors such as dust, oil, moisture and temperature.
Heat in particular is a deadly enemy of sensitive microelectronics.

**For example, a general rule of thumb for semi-conductors is that an increase in the operating temperature of 10°C, in relation to the maximum permissible operating temperature, will shorten its service life by one-half.**
In order to guarantee proper functioning of the electronics, this heat needs to be dissipated.

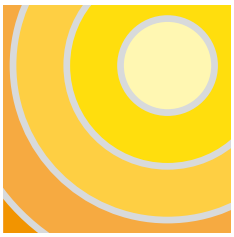
## Ambient conditions


Heat

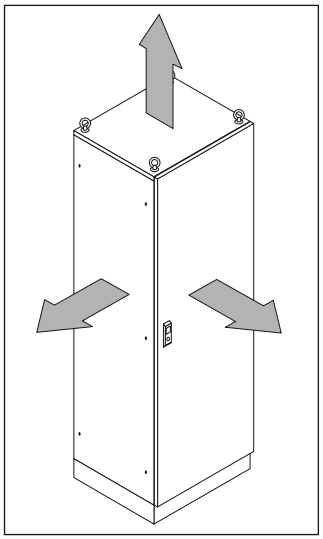

Dust

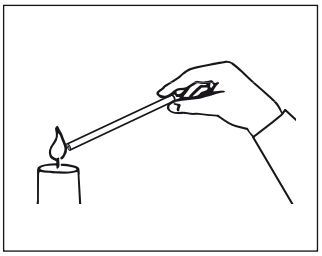
Cool

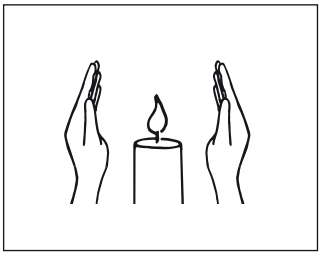
## Enclosure interior problems


Heat loss

Condensate


Convection


Heat conduction


Radiation

**There are three basic forms of heat transfer:**

**Thermal conduction:**
Heat is transported by matter, without the matter itself being moved. The energy is passed from particle to particle.

**Convection:**
Energy flows with the matter. The transport medium, e. g. a liquid or gas, takes up energy in the form of heat and dissipates energy as heat.

**Radiation:**
Heat is passed from one body to another in the form of radiation energy, without a medium material.

The decisive factor for the type of heat dissipation to be used in enclosures is whether they are open (air-permeable) or closed (air-tight). Whereas in open enclosures, the heat is dissipated by means of air circulation, in closed enclosures the heat can only be dissipated via the enclosure wall.

Rittal cooling units provide the ideal solution for ensuring an optimum operating temperature inside an air-tight enclosure, even at high external temperatures.

**On the following pages, you will find a chronological guide to help you to easily find the most suitable climate control solution.**

# Fast selection

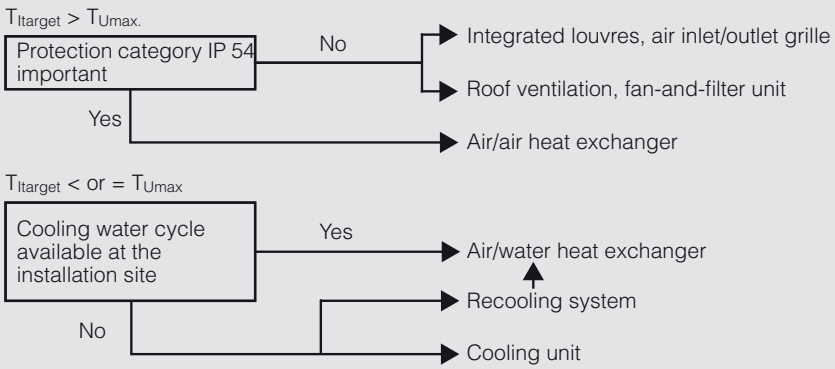
**Before you start, please consider your peripheral conditions such as external temperature, internal temperature and protection category.**



## Heat dissipation

For targeted, effective cooling, it is important to ensure correct calculation of the required climate control components and where applicable, perform thermal analysis using computer-assisted flow models (CFD – Computational Fluid Dynamics).

**Basic selection:**




$T_I$ = Required internal temperature of enclosure [°C]
$T_U$ = Ambient temperature of enclosure [°C]

**The following pages contain detailed calculation formulae for your chosen option.**

### Calculation of effective enclosure surface area

Of the variables required for calculation purposes, the effective enclosure surface area A requires special explanation. The thermal output dissipated by the enclosure not only depends on its actual surface area; the installation type of the enclosure also plays a decisive role.

An enclosure which stands in a room unobstructed on all sides may dissipate more heat than one sited against a wall or in a niche. For this reason, there are precise specifications on how to calculate the effective enclosure surface area depending on the **type of installation site**. The formulae for calculating A are specified in DIN 57 660, part 500 and IEC 890 (see table below).

**Enclosure installation type** to IEC 890

Single enclosure, free-standing on all sides
Single enclosure for wall mounting
First or last enclosure in a suite, free-standing
First or last enclosure in a suite, for wall mounting
Enclosure within a suite, free-standing
Enclosure within a suite, for wall mounting
Enclosure within a suite, for wall mounting, covered roof surfaces

| Installation type to IEC 890 | Formula for calculating A [$m^2$] | |
|---|---|---|
| | A = 1.8 x H x (W + D) | + 1.4 x W x D |
| | A = 1.4 x W x (H + D) | + 1.8 x D x H |
| | A = 1.4 x D x (H + W) | + 1.8 x W x H |
| | A = 1.4 x H x (W + D) | + 1.4 x W x D |
| | A = 1.8 x W x H | + 1.4 x W x D + D x H |
| | A = 1.4 x W x (H + D) | + D x H |
| | A = 1.4 x W x H | + 0.7 x W x D + D x H |
| | A = Effective enclosure surface area<br>W = Enclosure width [m]<br>H = Enclosure height [m]<br>D = Enclosure depth [m] | |

# Project planning

## General information

3.1

### Calculation bases for enclosure climate control

In natural convection, heat loss is dissipated to the outside via the enclosure panels. The pre-requisite for this is that the ambient temperature must be lower than the temperature inside the enclosure. The maximum temperature increase $(\Delta T)_{max.}$ which may occur inside an enclosure compared with the ambient air is calculated as follows:

$$(\Delta T)_{max.} = \frac{\dot{Q}_v}{k \cdot A}$$

**Note:**
If the heat loss inside the enclosure is not known, this basic formula can be used to calculate actual heat loss, by measuring the ambient temperature $T_U$ and the enclosure internal temperature $T_I$:

$$\dot{Q}_v = A \cdot k \cdot \Delta T \text{ (watts)}$$

$\dot{Q}_v$ = Heat loss installed in the enclosure [W]

$\dot{Q}_s$ = Heat emitted by the enclosure surface [W]
$\dot{Q}_s > 0$: Radiation ($T_I > T_U$)
$\dot{Q}_s < 0$: Irradiation ($T_I < T_U$)

$\dot{Q}_K$ = Required cooling output of an enclosure cooling unit [W]

$\dot{Q}_H$ = Required thermal output of an enclosure heater [W]

$q_w$ = Specific thermal output of a heat exchanger [W/K]

$\dot{V}$ = Required volumetric air flow of a fan-and-filter unit to maintain the maximum permissible temperature difference between the extracted air and the emitted air [$m^3/h$]

$\Delta T$ = $T_I - T_U$ = Max. admissible temperature difference [K]

A = Effective, heat loss-dissipating enclosure surface area to IEC 890 [$m^2$]

k = Heat transfer coefficient [$W/m^2K$]
for sheet steel k = 5.5 $W/m^2K$

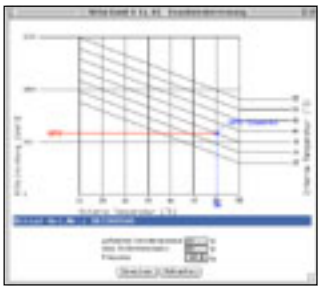
### Software Rittal Therm

**Make calculation even easier and faster by using our project planning software Rittal Therm, Model No. SK 3121.000.**

### Interactive performance diagrams

Interactive performance diagrams may be found on the Internet at **www.rittal.com** on the respective component data sheets in the “Product service” section, under the heading “Performance”.

Enter your required interior temperature and the maximum exterior temperature in the relevant boxes, then click on “Calculate”. The heat loss that may be dissipated under these conditions will be displayed.



## Enclosure cooling units

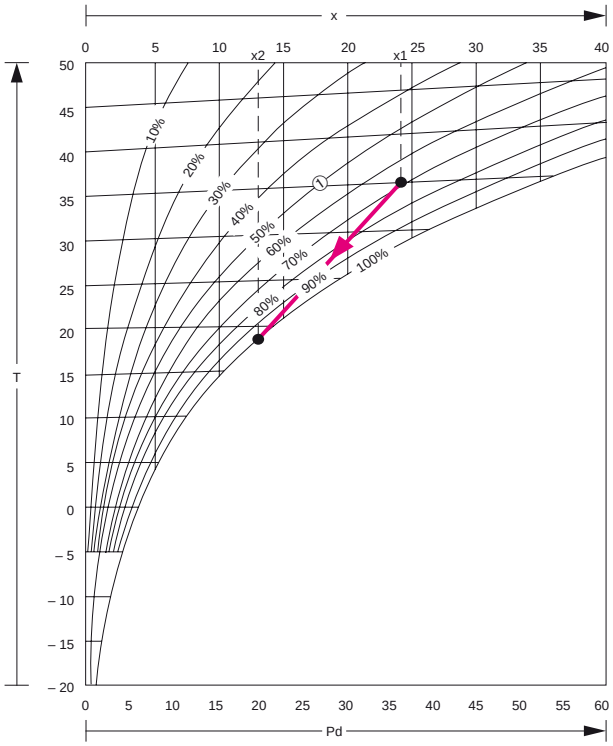
Calculate your required cooling output.

$$\dot{Q}_E = \dot{Q}_v - k \cdot A \cdot \Delta T$$

### Condensation and dehumidification of enclosure air when using cooling units

One unavoidable side-effect of using cooling units is the dehumidification of the enclosure's interior air. As it cools down, part of the humidity contained in the air condenses on the evaporator coil. This condensate must be reliably discharged from the enclosure. The amount of condensate occurring depends on relative humidity, the air temperature inside the enclosure and on the evaporator coil, and the air volume present in the enclosure. The Mollier h-x diagram shows the water content of air depending on its temperature and relative air humidity.

Mollier h-x diagram for calculating the water content of air.




$P_d$= Water vapour partial pressure (mbar)
T = Air temperature (°C)
x = Water content (g/kg dry air)
① = Relative humidity

### Practical tips

In all situations where optimum operating temperatures are required inside an enclosure, even at high external temperatures, a Rittal enclosure cooling unit can provide the right solution. It is even possible to cool the interior temperature of the enclosure to well below the ambient temperature.
The favourable aerodynamic arrangement of the air inlet and outlet openings in the internal and external circuits ensures optimum air circulation inside the enclosure. This sample calculation will show you a quick, time-saving method for calculating a cooling unit.

### Example:

An enclosure cooling unit commences operation with a temperature setting of $T_i$ = 35°C.
The relative ambient air humidity is 70%. If air at 35°C is passed over the evaporator coil, the surface temperature of the evaporator coil (evaporation temperature of the refrigerant) is approximately 18°C.
At the boundary layer adhering to the surface of the evaporator coil, water is deposited at the dew point. The difference $\Delta x = x_1 - x_2$ indicates how much condensation is incurred per kg of air with complete dehumidification. The leak-tightness of the enclosure has a decisive effect on the quantity of condensation.

The quantity of condensation is calculated from the following equation:

$$W = V \cdot \rho \cdot \Delta x$$

W = Water quantity in g
V = Volume of the enclosure in $m^3$
$\rho$ = Density of air $kg/m^3$
$\Delta x$ = Difference in water content in g/kg dry air (from the Mollier h-x diagram)

Enclosure door closed:
Only the enclosure volume is dehumidified.

$V = B \cdot H \cdot T = 0.6\ m \cdot 2\ m \cdot 0.5\ m$
$V = 0.6\ m^3$
$W = V \cdot \rho \cdot \Delta x$
$= 0.6\ m^3 \cdot 1.2\ kg/m^3 \cdot 11\ g/kg$
$W = 7.92\ g \triangleq 8\ ml$

Poorly sealed cable designs, damaged door seals and the attachment of display media to enclosure surfaces lead to increased rates of leakage in the enclosure. Hence, with a leakage rate of, say, 5 $m^3/h$, a continuous condensate volume of up to 80 ml/h may occur.

### Summary:

Enclosure cooling units should only operate with the door closed.

- Seal the enclosure on all sides.
- Use a door limit switch.
- Use TÜV-tested equipment.
- Only set the enclosure internal temperature as low as is actually needed.

## Recooling systems

Recooling systems may be used in all situations where a high cooling load is required, e.g. in process and machine cooling, in media cooling or when dissipating heat loss from enclosures via air/water heat exchangers.

Our project engineers will be happy to help you design a recooling system for your specific application area. An overview of the planning data required for this purpose can also be found on the Internet at **www.rittal.com** in the section on system climate control/recooling systems.

**Project planning examples of recooling systems may be found in Catalogue 31, page 606/607.**

## Cooling water

**Preparation and maintenance of the water in recooling systems**

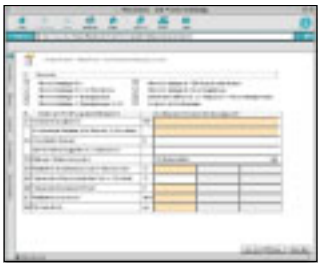
Depending on the type of installation to be cooled, certain requirements are placed on the cooling water with respect to purity. According to the level of contamination and the size and design of the recooling systems, a suitable process is used to prepare and/or maintain the water.
The most common types of contamination and most frequently used techniques to eliminate them in industrial cooling are:

| Contamination of the water | Procedure |
|---|---|
| Mechanical contamination | Filtering of water via<br>– Mesh filter<br>– Gravel filter<br>– Cartridge filter<br>– Precoated filter |
| Excessive hardness | Water softening<br>via ion exchange |
| Moderate content of mechanical contaminants and hardeners | Addition of stabilisers and/or dispersing agents to the water |
| Moderate content of chemical contaminants | Addition of passifiers and/or inhibitors to the water |
| Biological contaminants, slime bacteria and algae | Addition of biocides to the water |

## Form for designing recooling systems

Simply tick the type of system, and select or enter the criteria to suit your requirements. Please also include your name, company and address. Once you have completed the form, you can generate a PDF to print out or send via e-mail as an enquiry. The form for the design of recooling systems may be found on the Internet at

**www.rittal.com**
**–> Products**
**–> System climate control**
**–> Recooling systems**
**–> Form for designing recooling systems**

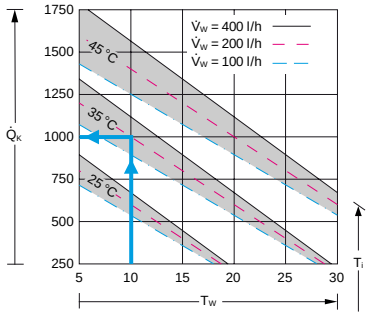


## Air/water heat exchangers

**Calculate your required cooling output.**

$$\dot{Q}_E = \dot{Q}_v - k \cdot A \cdot \Delta T$$

**e. g. performance diagram**
**Air/water heat exchanger 1000 W**
Model No. SK 3217.100




$T_w$ = Water inlet temperature (°C)

$\dot{Q}_K$= Continuous useful cooling output (W)

$T_i$ = Enclosure internal temperature (°C)

3.4

### Notes on water quality

For safe operation of the equipment, it is essential to observe the VBG guidelines on cooling water (VGB R 455 P).

Cooling water must not contain any limescale deposits or loose debris; in other words, it should have a low level of hardness, particularly a low level of carbon hardness. For recooling within the plant, the carbon hardness should not be too high. On the other hand, however, the water should not be so soft that it attacks the operating materials. When recooling the cooling water, the salt content should not be allowed to increase excessively due to the evaporation of large quantities of water, since electrical conductivity increases as the concentration of dissolved substances rises, and the water thereby becomes more corrosive. For this reason, not only is it always necessary to add a corresponding quantity of fresh water, but also to remove part of the enriched water.

Gypsiferous water is unsuitable for cooling purposes because it has a tendency to form boiler scale, which is particularly difficult to remove. Furthermore, cooling water should be free from iron and manganese, because otherwise deposits may occur which settle in the pipes and block them. At best, organic substances should only be present in small quantities, because otherwise sludge deposits and microbiological contamination may occur.

| | Material of water-carrying parts | |
|---|---|---|
| **Hydrological data** | CuAl | V4A[1)] |
| pH value | 7 – 8,5 | 6 – 9 |
| Carbon hardness | > 3 < 8° dH | 1 – 12° dH |
| Free carbonic acid | 8 – 15 mg/dm$^3$ | 1 – 100 mg/dm$^3$ |
| Accompanying carbonic acid | 8 – 15 mg/dm$^3$ | free |
| Aggressive carbonic acid | 0 mg/dm$^3$ | 0 – 400 mg/dm$^3$ |
| Sulphides | free | free |
| Oxygen | < 10 mg/dm$^3$ | < 10 mg/dm$^3$ |
| Chloride ions | < 50 mg/dm$^3$ | < 200 mg/dm$^3$ |
| Sulphate ions | < 250 mg/dm$^3$ | < 500 mg/dm$^3$ |
| Nitrates and nitrites | < 10 mg/dm$^3$ | < 100 mg/dm$^3$ |
| COD | < 7 mg/dm$^3$ | < 40 mg/dm$^3$ |
| Ammonia | < 5 mg/dm$^3$ | < 20 mg/dm$^3$ |
| Iron | < 0.2 mg/dm$^3$ | free |
| Manganese | < 0.2 mg/dm$^3$ | free |
| Conductivity | < 2200 µS/cm | < 4000 µS/cm |
| Residue on evaporation | < 500 mg/dm$^3$ | < 200 mg/dm$^3$ |
| Potassium permanganate consumption | < 25 mg/dm$^3$ | < 40 mg/dm$^3$ |
| Suspended matter | < 3 mg/dm$^3$ | |
| | > 3 < 15 mg/dm$^3$ partial current purification recommended | |
| | > 15 mg/dm$^3$ continuous purification recommended | |

[1)] The complete absence of corrosion under experimental conditions suggests that solutions with a significantly higher salt content and greater corrosion potential (such as seawater) may still be tolerated.

## Air/air heat exchangers, fan-and-filter units

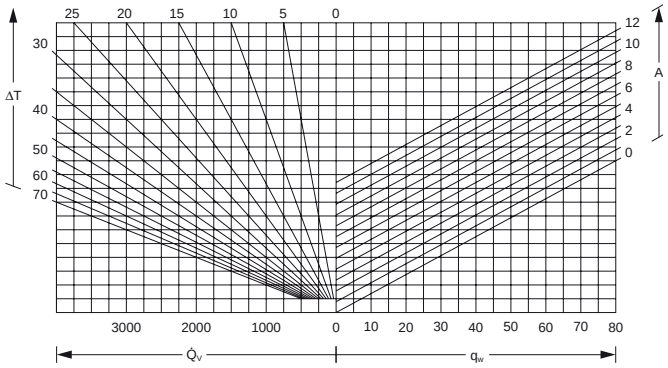


### Air/air heat exchangers

**Calculate the specific thermal output of the heat exchanger.**

$$q_w = \frac{\dot{Q}_v - (A \cdot \Delta T \cdot k)}{\Delta T}$$

**Selection diagram**




$\Delta T$ = Temperature difference (K)
$\dot{Q}_v$ = Heat loss (W)
$q_w$ = Specific thermal output (W/K)
A = Enclosure surface area to IEC 890 ($m^2$)
k = Heat transfer coefficient ($W/m^2K$)
for sheet steel k = 5.5 $W/m^2K$

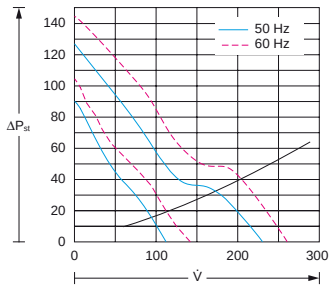
**Notes**
For ambient temperatures that are lower than the desired enclosure internal temperature, the use of air/air heat exchangers may be appropriate, particularly in cases where there are dust, oil and aggressive substances in the ambient air which must not be allowed to ingress the enclosure under any circumstances.

### Fan-and-filter unit

The following applies when calculating the volumetric air flow:

$$\dot{V} = f \cdot \frac{\dot{Q}_v}{\Delta T}$$

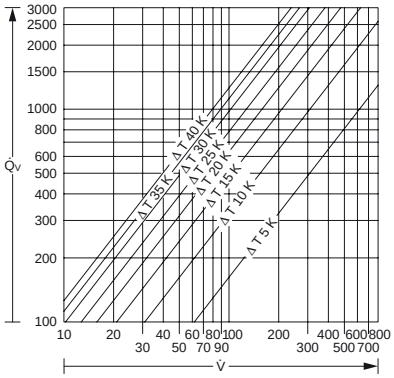
**Performance diagram SK 3325. . . .**




$\dot{V}$ = Volumetric flow ($m^3/h$)
$\Delta P_{st}$ = Stat. pressure difference ($P_a$)

f = 3.1 $m^3$ · K/Wh at h = ( 0 to 100)
f = 3.2 $m^3$ · K/Wh at h = (100 to 250)
f = 3.3 $m^3$ · K/Wh at h = (250 to 500)
f = 3.4 $m^3$ · K/Wh at h = (500 to 750)
f = 3.5 $m^3$ · K/Wh at h = (750 to 1000)
f = Compensating factor
h = Height above sea level [m]

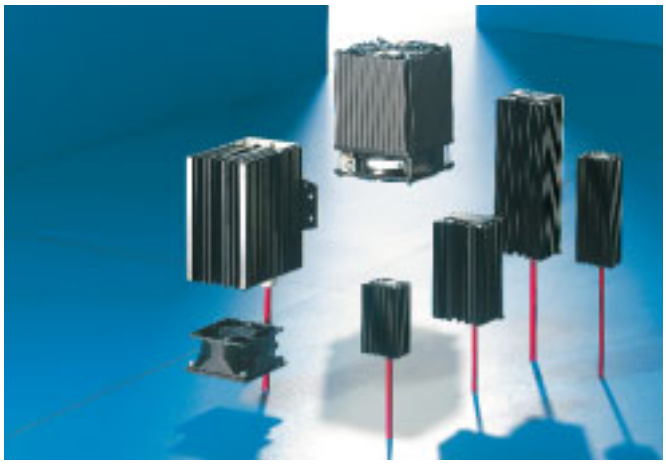
**Selection diagram**




$\dot{V}$ = Volumetric flow ($m^3/h$)
$\dot{Q}_V$ = Heat loss (W)

The styling of the vent louvres in Rittal fan-and-filter units guarantees exemplary stability of the air volumes in relation to pressure loss. The correct fan-and-filter unit has been chosen if the specified heat loss is dissipated whilst complying with the desired maximum enclosure internal temperature.

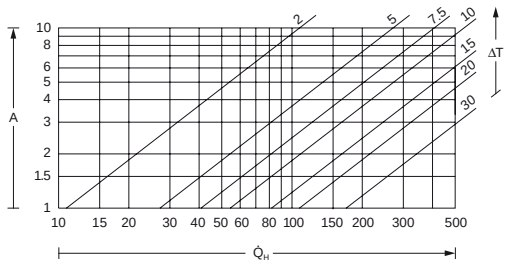
## Enclosure heaters



The required thermal output is calculated from

$$\dot{Q}_H = A \cdot \Delta T \cdot k$$

### Heating performance diagram




$\dot{Q}_H$ = Thermal output (W)
A = Enclosure surface area to IEC 890 ($m^2$)
ΔT = Temperature difference (K)

Based on:
Indoor siting, static air,
heat transfer coefficient k = 5.5 $W/m^2$ K
For outdoor siting (moving air): Double the thermal output.

# Cooling units

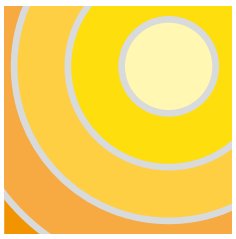
## Applications

Cooling units keep the enclosure internal temperature at a constant level, even to below room temperature. The air routing meets individual requirements. Two separate circuits prevent the ingress of dust into the enclosure.

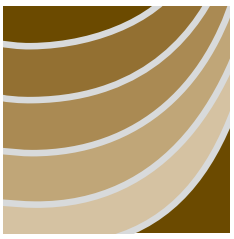
- **Climate controlled enclosures**
- **Roof-mounted cooling units**
- **Wall-mounted cooling units**



### Ambient conditions



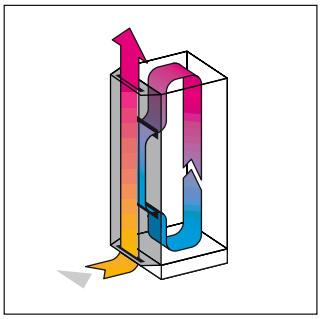
Heat



Dust

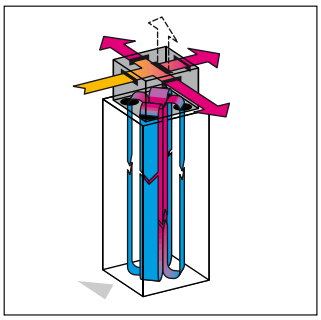
### Integral cooling system/climate controlled enclosures

The combination of enclosure and cooling components achieves particularly effective cooling. Assembly time is eliminated. The investment costs for the complete unit offer exceptional value for money.



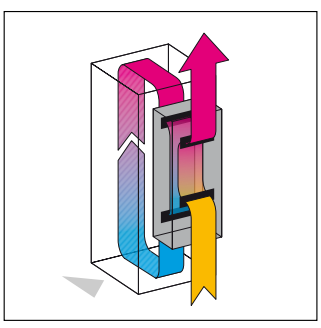
### Roof-mounted cooling units

Requirement-oriented routing of cooling air in the internal circuit is possible, with up to four cold air outlet openings and the optional use of ducts. In the external circuit, the heated air is expelled to the rear, left and right, and optionally upwards. This means that the enclosure may be sited in a bayed suite or close to the wall.



### Wall-mounted cooling units

Depending on the space and design requirements, internal mounting, partial internal mounting and external mounting are all possible. Thanks to large distances between the air intake and outlet openings, effective cold air throughput of the enclosure is achieved.



## Selection criteria

Enclosure climate control poses escalating demands on integration and adaptation to the local conditions and the existing process control and monitoring system. Rittal offers the right solution to suit every requirement.

When selecting the appropriate cooling unit for your enclosure, please observe the following points:

- What is the installation type to IEC 890? (see page 27, calculation bases)
- What ambient conditions are anticipated (ambient temperature and humidity)?
- What is the required maximum internal temperature of the enclosure ($T_i$)?
- What is the heat loss from electronic components inside the enclosure?
- Is there a requirement regarding the protection category to EN 60 529/IEC 529?
- What type of ambient pollution, such as dust, oil and chemicals, are the cooling units exposed to?
- For bayed enclosure suites, the output irradiated from neighbouring units may also need to be taken into account.
- Good ventilation should be ensured at the site of installation (for example, the heat dissipated by the cooling unit may cause a significant rise in the temperature of small rooms).
- Particularly with poor ambient conditions, such as dirt or small rooms, air/water heat exchangers should be used.



### Important

### Proper use of enclosure cooling units

In order to ensure the proper use of enclosure cooling units, the following points should be observed:

1. The unit must only be installed and opened by authorised, expertly trained personnel.
2. Choose a location for the cooling unit which ensures excellent ventilation. The site must be free from excessive contamination and moisture. For example, the atmosphere must not contain any conductive dusts or corrosive media.
3. The mains connection data (connection voltage and frequency) specified on the rating plate must be observed. In the case of 400 V, 2~ cooling units, we recommend the use of transformer circuit-breakers, and for three-phase units, the use of motor circuit-breakers is advisable.
4. The prescribed electrical protection devices must be connected upstream of the unit. No additional temperature control must be connected upstream of the device at the supply end. The pre-fuse specified on the rating plate should be provided as line protection. Observe the locally valid regulations when installing.
5. Where a door contact switch is used, a shielded cable should be used in environments with increased levels of electromagnetic interference.
6. The temperature range specified on the rating plate must be observed when operating the cooling unit, both indoors and outdoors.
7. The enclosure must be sealed on all sides (IP 54).
8. The air inlet and outlet openings in the internal circuit of the cooling unit must not be obstructed.
9. The cold air flow should not be directed straight at electronic components, to prevent the formation of condensation.
10. The unit must only be installed horizontally, in accordance with the prescribed installation position. The maximum permissible deviation from the horizontal is 2°.
11. After disconnecting from the supply voltage, the cooling circuit of the cooling unit must not be switched back on for at least 5 minutes.
12. The customer must not make any modifications to the cooling unit.
13. The heat loss of the components installed in the enclosure must not exceed the specific useful cooling output of the cooling unit.
14. The installation instructions contained in the cooling unit manual must be observed in full.

## Assembly

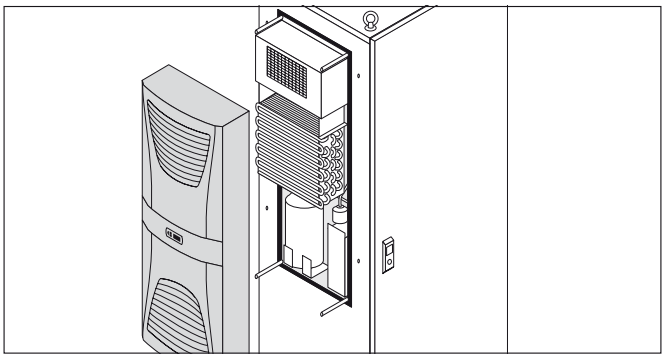
### Sealing of the enclosure

The enclosure must be sealed on all sides (IP 54). Particular attention should be paid to the sealing of the area around the cable entry openings and above all, the floor section of the enclosure.

Additionally, the door seal must be in perfect condition.

The sealing material included with the cooling units must be applied in accordance with the installation instructions.

Take care not to bend the side panel or enclosure door.





### Installation on enclosures

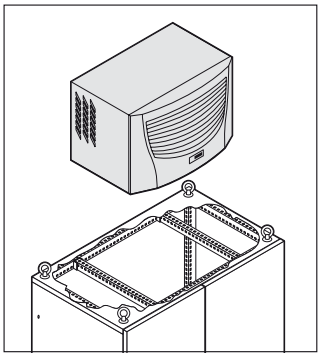
The cooling unit must be correctly installed.

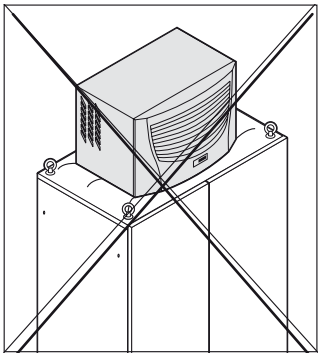
The roof plate of the enclosure must not be allowed to give under the weight of the cooling unit.

If necessary, additional stays should be used. Do not obstruct the air inlets and outlets of the internal circuit.

**Note:**
For TopTherm roof-mounted units, TS 8 roof plates prepared with mounting cut-outs and reinforcement strips for all standard enclosure sizes are available as an accessory (Cat. 31, page 664).

When installing after the unit has been assembled, the twin-threaded bolts supplied loose should be screwed into the core holes in the plastic base on the underside of the device, with a maximum torque of 3 Nm.



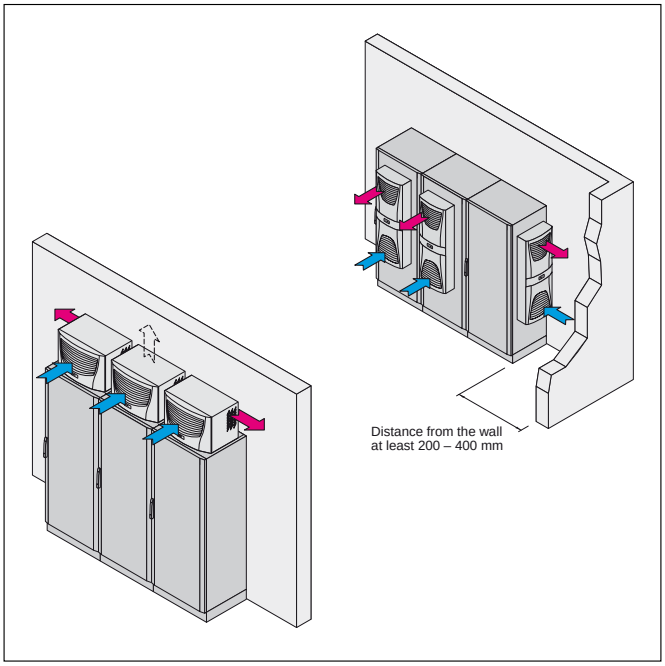


## External circuit
## Flow and siting conditions

In the outer circuit, enclosure cooling units should be spaced 200 – 400 mm from the wall and/or from each other (air inlet and outlet openings). In order to ensure adequate air circulation, at least one air outlet opening must be kept free.
If this clearance cannot be maintained, air baffle plates will need to be used.

**The external circuit supports all siting variants.**
Thanks to their compact dimensions and external air routing design, roof-mounted cooling units may even be installed in low-height rooms and with bayed enclosure suites.
Air intake is always from the front. The air is expelled at the sides and rear. An outlet to the top is also possible as an option. In other words, regardless of which siting mode is chosen, one air outlet must always be kept free.

**Siting options**
There are no restrictions here. Only the air intake and exhaust area in front of the cooling unit must be kept free.
Wall-mounted cooling units may be mounted on the rear panel, side panels or door of the enclosure.



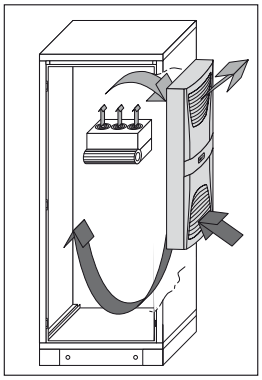


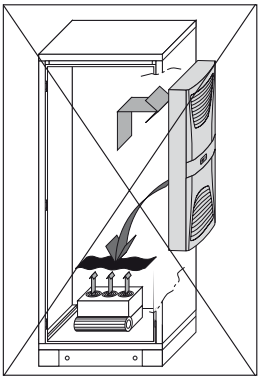

## Internal circuit – Wall-mounted units, flow conditions

Attention should be paid to components/electronic components equipped with their own ventilation systems, such as blowers and axial fans. If their air flow is directed against the chilled air flow of the cooling unit, this could cause an air short-circuit and prevent adequate climate control. In the worst case, this air short-circuit could reach the cooling unit itself, and the internal safety valves would discontinue cooling operation.

**Note:**
Never direct the chilled air flow at active components.

**Accessories:**
Air diverter, see Cat. 31, page 659.





## Air routing

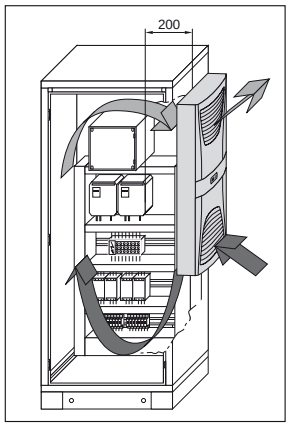
### Free air circulation

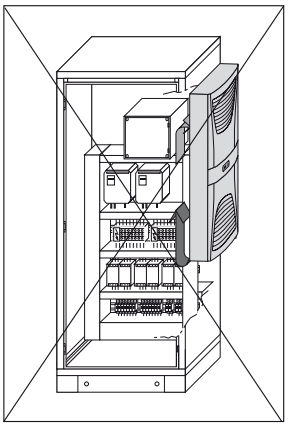
It is important to ensure “even” air circulation inside the enclosure. Air inlet and outlet openings in the internal circuit must on no account be obstructed by electrical installations. This would prevent air from circulating inside the enclosure. Under such conditions, the cooling capacity of the device would not be adequately utilised. A clearance of > 200 mm must be guaranteed.

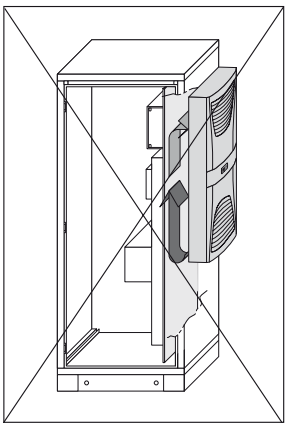
**Note:**
Wall-mounted cooling units should never be fitted directly behind the mounting plate. Active power components are located on the front of the mounting plates. The cooling unit would then be left to operate in its own air short-circuit.

If it is impossible to install the device any other way, appropriate air baffle plates should be used, and air inlet and outlet openings should be provided in the mounting plate.

**Accessories:**
Air diverter, see Cat. 31, page 659.



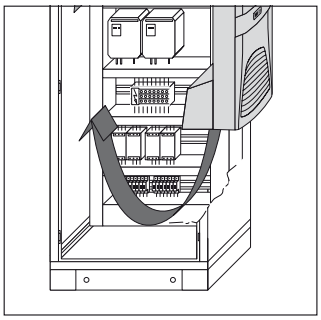





### Air diverter systems for wall-mounted units

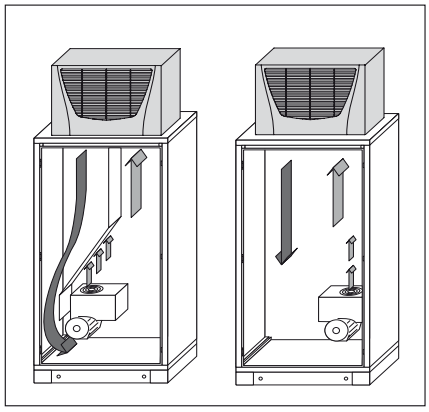
See Cat. 31, page 659.

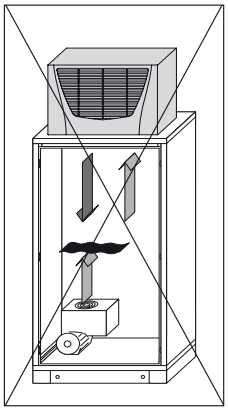
For use in climate controlled enclosures, climate control doors, climate control side panels and TopTherm wall-mounted cooling units. For targeted air routing of the cold air in a downward direction. Particularly well-suited for densely-packed electrical components in the lower section of the enclosure.



### Internal circuit – Roof-mounted units, flow conditions

When using roof-mounted units, particular attention should be paid to the air flow from the blowers of built-in electronic components (such as frequency converters and other drive units).





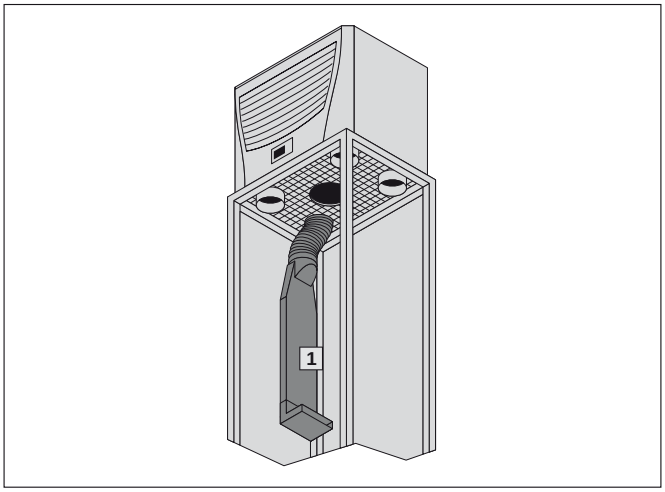
## Air-ducting system

**for TopTherm roof-mounted cooling units**

With the air duct system, it is possible to route the cold air directly to specific areas of the enclosure. This effectively eliminates the risk of “short circuits” in the air circulation due to self-ventilated components.

**Note:**

- Never direct the cold air flow straight at active components.
- Route the air duct system directly downwards with no bends.
- Cold air must be able to escape unobstructed at the end of the duct.
- Additional deflections will reduce the useful cooling output.
- When using the ducting system, the performance of the cooling unit may be reduced, depending on the respective application.
- The air duct system should not be extended.
  **CAUTION** Risk of icing!




**Accessories:**

1 Air duct system for roof-mounted units, see Cat. 31, page 658.



## Stopper

**for TopTherm roof-mounted cooling units**

For sealing any cold air outlets that are not required.

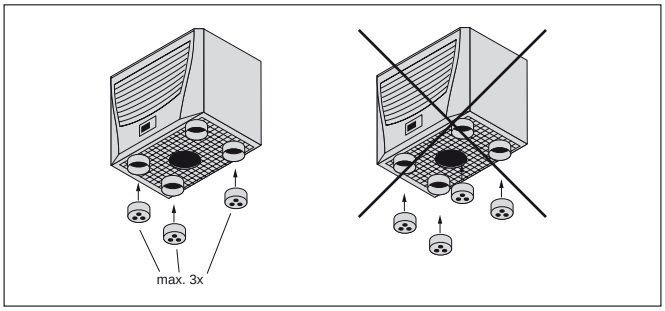
**Note:**

At least one outlet opening must always remain open!

Please note that if two or three openings are closed, the cooling output may be reduced by 20 % and 30 % respectively!

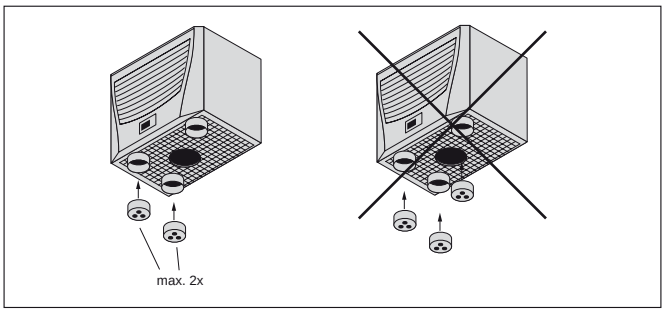
**SK 3286.880** for units

SK 3383.xxx SK 3273.xxx
SK 3384.xxx
SK 3385.xxx




**SK 3286.780** for units

SK 3382.xxx
SK 3359.xxx



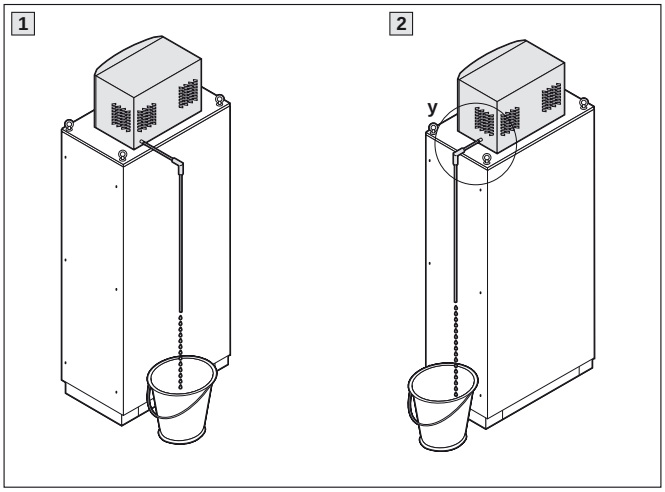

**SK 3286.980** for units

SK 3386.xxx
SK 3387.xxx

## Condensate management

### Condensate routing (roof-mounted units)

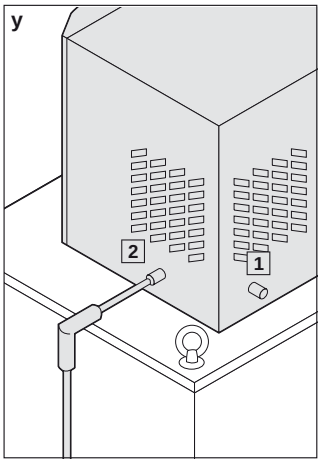
Any condensation which forms on the evaporator coil (with high humidity and low enclosure interior temperatures) is routed to the right and/or downwards out of the device via a drain in the evaporator tray. For this purpose, a piece of hose should be connected to one of the two condensate nozzles (1 or 2). **The drain which is not required should be tightly sealed. The condensate must be able to run off freely. If the condensate is to be drained off over a greater distance, then care must be taken that the hose is free from kinks**, and checked for correct drainage. Units with a Comfort controller are additionally equipped with a condensate alarm.

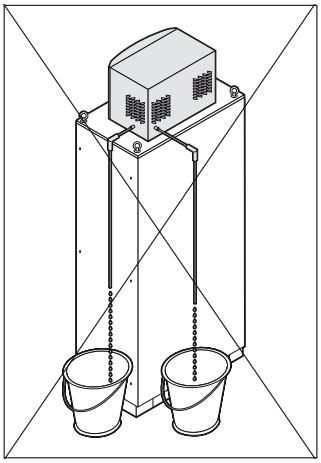


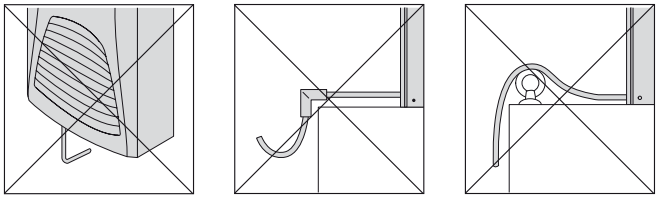

1 Condensate discharge rear
2 Condensate discharge right



**Note:**
**Condensate discharge (wall-mounted units)**
For wall-mounted units, a hose should be connected to the condensate nozzle on the bottom of the unit.





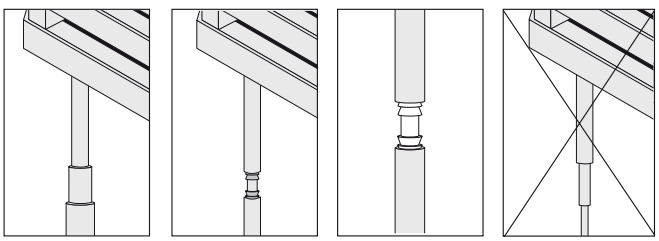
The condensate drain pipe should be laid with a gradient, taking care to ensure there are no kinks in the pipe!

### Condensate discharge

If the condensate discharge is extended, its cross-section must not be reduced.

| Condensate hose | For unit(s) |
|---|---|
| SK 3301.608 (8 x 1.5) | SK 3302.XXX |
| SK 3301.610 (10 x 1.5) | SK 3303.xxx/SK 3361.xxx |
| SK 3301.612 (12 x 2) | SK 3304.xxx/SK 3305.xxx<br>SK 3328.xxx/SK 3329.xxx<br>SK 3332.xxx/SK 3382.xxx<br>SK 3359.xxx/SK 3383.xxx<br>SK 3384.xxx/SK 3385.xxx<br>SK 3386.xxx/SK 3387.xxx<br>SK 3366.xxx/SK 3377.xxx |

**Accessories:**
PVC condensate hose



## Condensate evaporation, electrical

**integrated into TopTherm cooling units**

Condensate arising inside the enclosure or on the evaporator coil of the cooling unit is effectively evaporated. The evaporator device inside the cooling units has a very high evaporation output (several litres per day). This is achieved thanks to the principle of direct evaporation. Important note: The enclosure must be sealed on all sides.

Energy-efficient: Activation of the evaporator device is via a separate heater cartridge. “Condensate evaporation” based on the hot gas bypass principle is too ineffective, due to inadequate evaporation temperatures.

**Advantage:**

- Safe use: No condensate drips onto the factory floor (no puddles/no risks of slipping/accidents).
- No need to empty the condensate collecting receptacles.
- No time-consuming laying of condensate hoses required.

The internal and external units are acitve “direct evaporator coils”, which actively evaporate the condensate incurred.

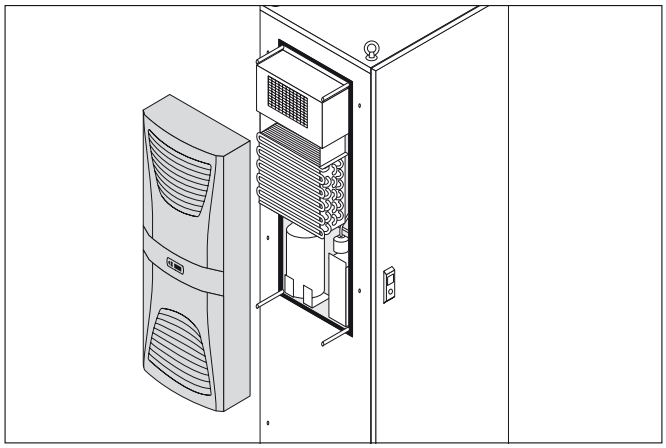
**Advantage:**

- No collecting vessel required
- No long hosepipes

**Note:**

For roof and wall-mounted units, either external evaporator units or integral condensate evaporators may be used.

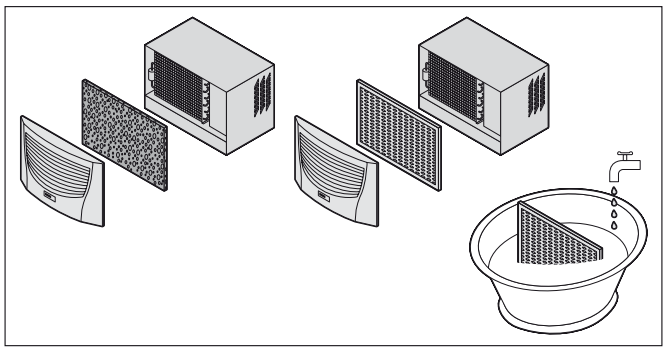
TopTherm cooling units are available with integrated electronic condensate evaporation and external evaporator units for retro-fitting.



## Filter mats

In dusty environments, we recommend the use of filter mats to make it easier to clean the cooling unit.
The filter should be changed at regular intervals, depending on the level of contamination.

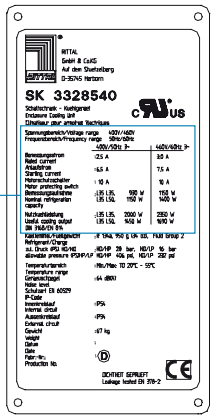
If the air is oil-contaminated, it is better to use metal filter mats which may be cleaned with appropriate detergents and reused.



## Electrical connection and control

### Supply connection

- Supply connection data (voltage and frequency) must be observed in accordance with the rating plate.
- The pre-fuse specified on the rating plate must be used.




| | | |
|---|---|---|
| Voltage range | 400 V/460 V | |
| Frequency range | 50 Hz/60 Hz | |
| | 400 V/50Hz 3~ | 400 V/60Hz 3~ |
| Rated current | 2.5 A | 3.0 A |
| Start-up current | 6.5 A | 7.5 A |
| Motor circuit breaker | 10 A | 10 A |
| Rated consumption | L35 L35 930 W<br>L35 L50 1150 W | 1150 W<br>1400 W |
| Useful cooling output | L35 L35 2000 W<br>L35 L50 1450 W | 2350 W<br>1690 W |
| Coolant / filled weight | R 134a, 950 g (34 oz), Fluid Group 2 | |

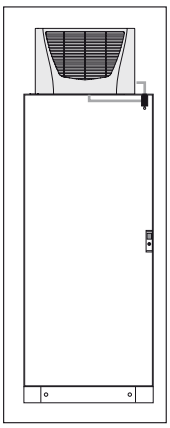
4.6

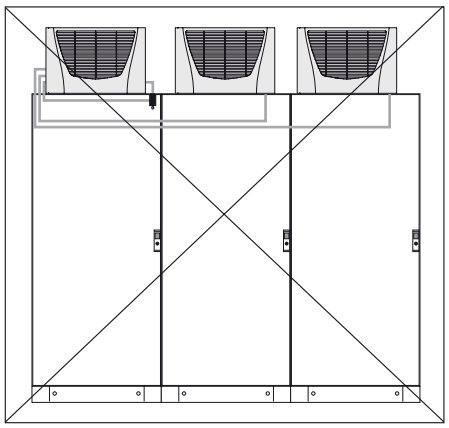
### Use of door operated switches

One floating door-operated contact should be used for each unit; under no circumstances must several cooling units be operated via one door operated switch.

In environments with increased electromagnetic interference, a shielded cable should be used.
Alternatively, the door contact may be switched e.g. via an additional relay in the vicinity of the cooling unit.

**Note:**
The cables should be laid separately from the mains cables; short cable distances should be observed.

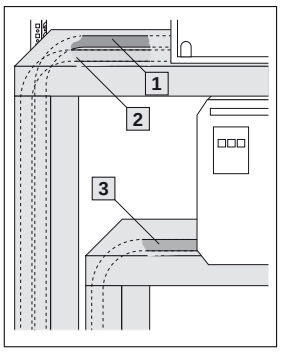


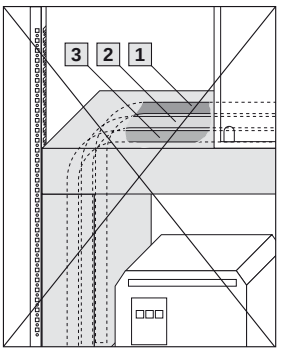


### Cabling

1 Signal data cable
2 Control cable
3 Motor cable

The power cable, power supply unit cable, signal cable and data cable must be laid separately; cable lengths should be kept as short as possible. Avoid coupled sections.



## Intelligent control

The two controller variants for operational reliability offer a comprehensive range of functions. Essential control electronics are well protected and cooled in the inner circuit.

**Both variants have the following properties:**

- Three voltage options: 115 V, 230 V, 400/460 V 3~
- Integral start-up delay and door limit switch function
- Icing protection function
- Monitoring of all motors
- Phase monitoring for three-phase units

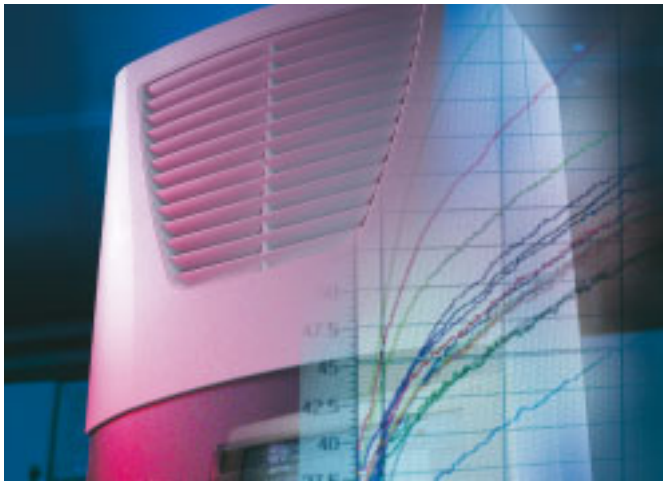
**Basic controller:**

- Visualisation of the operating status via LED display:
  – Voltage applied, functions OK
  – Door open
  – Overtemperature
  – High-pressure monitor has switched
- Switching hysteresis: 5 K
- Floating fault signal contact in case of overtemperature
- Setpoint adjustable from outside via potentiometer (setting range 20 – 55 °C)

**Comfort controller:**

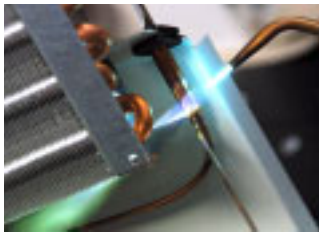
- Master / slave function for up to 10 units, i.e. the unit which reaches the setpoint first reports this to the “master”, which switches all the other “slaves” on and off. The unit in which the door limit switch function is activated reports this to the “master”, which deactivates all the “slaves”.
- Switching hysteresis: 2 – 10 K; preset to 5 K
- System alarm, individually configurable for 2 floating fault signal contacts
- Visualisation of the current enclosure internal temperature and all system messages on the display
- Storage of all system statuses in the log file
- Optional extension card **(SK 3124.200)** with RS 232, RS 485, RS 422 and PLC interface for integration into superordinate remote control systems, e.g. with CMC, is also possible

## Benefits



Rittal TopTherm cooling units offer holistic process protection. Above all, this includes the cooling of sensitive electronics in enclosures and cases for industrial process control. Climate control is largely independent from the respective ambient conditions. But these are not isolated solutions – with Rittal, everything is interconnected. The monitoring and control of these eco-friendly, energy-efficient units is perfectly interconnected.





### Service benefits included

The assemblies, their arrangement and the divided internal case construction make all types of maintenance and servicing work much easier.

**User-friendly monitoring**
Whether you opt for a Basic or Comfort controller, compliance with the required parameters is clearly indicated. Naturally, remote monitoring from a central control room is also supported.

### Benefits in brief !

- **Simple component replacement: clear assembly, electronic connectors**
- **Fast filter replacement: Clip fastening of the louvred grille**
- **Reduced warehousing costs: 4 filter sizes for all TopTherm unit types**
- **Less contamination**
- **Easier to clean**
- **Reduced maintenance**
- **Increased efficiency**

### Nano-technology – dirty on the outside – clean on the inside

**Innovative coating for lasting cooling performance**
Layers of dust on heat exchanger surfaces in the outer circuit of cooling units may reduce efficiency by 30 to 50 %, due to their insulating effect. A revolutionary RiNano-coating prevents this, thanks to its water, dirt and oil-repellent properties, and ensures consistent long-term cooling output. The servicing and maintenance intervals required are extended, and cleaning work becomes much easier.

## Benefits

**Rittal TopTherm wall-mounted cooling units:**

Top design and top performance with a host of assembly benefits. The Rittal platform strategy with system-wide mounting cut-outs to fit cooling units and air/air heat exchangers allows easy adaptation to the required cooling output, even retrospectively.

**Rittal TopTherm roof-mounted cooling units:**

Top design and top performance with a host of assembly benefits and sophisticated air routing. The system-wide mounting cut-outs may also be used for the new roof-mounted fans for TS. Superb performance plus cost-cutting design.



### External, internal or partial internal mounting

This makes optimum allowance for the available space conditions. The enclosure surface containing the cut-out for partial or full internal mounting is stabilised by the divided internal case construction. Special internal or external mounting kits are not required.

### Cut your costs

All rotary current units are designed for a voltage range of 400/460 V and a frequency range of 50/60 Hz without rewiring. No need for expensive additional transformers.

The design and arrangement of the assemblies and membranes of the TopTherm cooling units have been optimised for maximum performance.

### Flexible performance

Just 5 mounting cut-outs for 8 different output categories in 35 design variants provide investment security and facilitate easy adaptation of the cooling output to the ambient conditions and the installed heat loss.

### Rittal platform strategy

TopTherm air/air and air/water heat exchangers are also compatible with the mounting cut-outs of wall-mounted cooling units.

### Benefits in brief !

- **Wide output range from 225 to 4000 W**
- **Extensive control and monitoring features, even with the basic version**
- **Three-phase cooling units support multiple voltages as standard**
- **Uniform, performance-related, system-wide mounting cut-outs**
- **To match TopTherm air/air heat exchangers.**

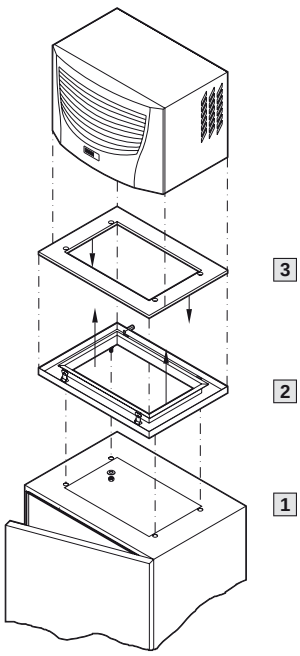
### Important

- Air inlet and outlet openings in the internal and external circuit must not be obstructed by electrical installations.

**General remarks see page 33**
**Calculation formulae see page 27**
**or on our website: www.rittal.com**

### Quick-change frame

Together with the seal, the lower part of the two-part quick-change frame is screw-fastened to the enclosure. This makes it possible to mount the connector-ready cooling unit onto the enclosure and remove it from the outside, using quick-release fasteners.
During servicing work, this means shorter assembly times and hence minimised down-time. What is more, the quick-change frame offers effective protection against the ingress of oil into the enclosure in oily atmospheres, thanks to its integral drainage trough.




1 Roof plate
2 Quick-change frame, base part
3 Quick-change frame, top part

### Roof plates

There are roof plates pre-equipped with a mounting cut-out available to fit all standard enclosure dimensions and cooling unit output categories. Manual machining of the mounting cutouts has been eliminated altogether.

### Benefits in brief !

- **Wide output range from 500 to 4000 W**
- **Extensive control and monitoring features, even with the basic version**
- **Rotary current units support multiple voltages as standard**
- **Uniform, performance-related, system-wide mounting cut-outs**
- **Targeted, individual air routing**

### Important

- Avoid overloading the roof plate by using stays (with TS 8 system accessories)

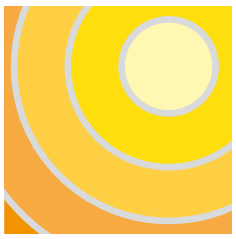
**General remarks see page 33**
**Calculation formulae see page 27**
**or on our website: www.rittal.com**

# Recooling systems

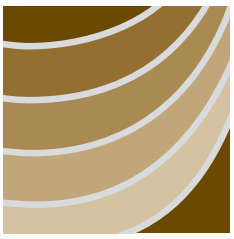
## Applications

Recooling systems ensure centralised, efficient cooling and provision of the cooling medium (generally water), and are used with particularly high heat loads. They may serve several pieces of equipment simultaneously, and are particularly effective in terms of cooling output.

### Ambient conditions



Heat



Dust

5.1

## Application diversity of centralised cooling technology

**Enclosure cooling**
In conjunction with air/water heat exchangers, optimum dissipation of high heat loads is guaranteed, even under extreme ambient temperatures and air contamination levels.

**Cooling of liquid media**
The direct and indirect cooling of liquids is essential for ensuring the required levels of machine accuracy and speed.

**Process cooling**
High-quality material processing, such as laser cutting, necessitates high levels of temperature precision with simultaneous cooling of the peripheral technology.

## Selection criteria

Generally speaking, recooling systems are divided into **open** and **closed** systems.

In the pressure-sealed configuration, the water circuit is equipped with a pressure relief valve and automatic exhaust. In this way, the cooling medium volume can be routed directly to the consumer with the integral pump, and no additional tank reservoir is needed.

Recooling systems designed as an open system have a tank made of PP plastic or stainless steel 1.4301 built into the recooling system.

If a recooling system is required to serve several pieces of equipment having different requirements in terms of inlet temperature and flow rate of the cooling medium, e.g. combined enclosure and process cooling, multi-circuit systems are used. In such cases, the different circuits may be tailored to the respective equipment.

If there is already a central cooling water supply available at the installation site, e.g. in the case of plant water in the automotive industry, recooling systems may optionally be fitted with a water-cooled condenser. One of the major benefits of this solution lies in the fact that the factory temperature is not additionally raised by waste process heat.

## Application diversity of centralised cooling technology

**Mini-recooling systems**
- Cooling output from 960 to 4,500 W
- Space-saving, compact design
- Attractive design
- Wall-mounted units: **Integration into the machine and enclosure housing** without using additional floor space

**Recooling systems integrated into the TS 8 Top enclosure system**
- Cooling output from 6,000 to 25,000 W
- Compact design
- **Option of integration into existing TS 8 enclosure combinations**

**Recooling systems in a floor-standing enclosure for water and oil**
- Cooling output from 2,100 to 26,100 W
- **Stand-alone enclosure**
- **Minimal base area**
- The functionally equipped design facilitates the cooling of oil and water.

**Recooling systems in an industrial enclosure**
- Cooling output from 32 to 172 kW
- **High cooling output with optimised space requirements**
- Removable enclosure panels offer easier accessibility in case of servicing

**Immersible recooling systems**
- Wherever it is necessary to cool **dirt-contaminated media** (metal swarf or aggressive sludge)
- High-end flat condenser of stainless steel
- Sealed cooling circuit

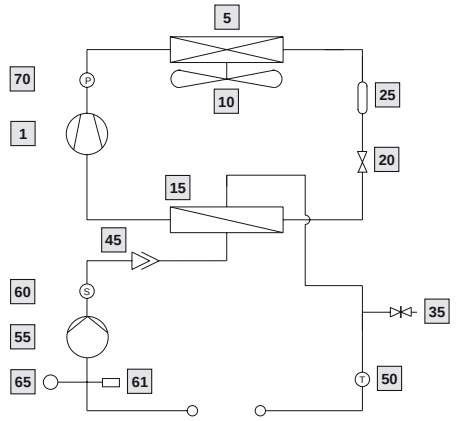
**Data centre with recooling systems**
- Recooling systems ensure central cooling and **supply of the cooling medium for liquid cooling systems**
- Spatial separation between refrigeration and cooling for temperature-neutral expansion of the data centre

## Selection criteria

### Recooling systems
**Closed system**

**Key to the drawing opposite:**
- 1 Compressor
- 5 Condenser
- 10 Condenser fan
- 15 Evaporator coil
- 20 Expansion valve
- 25 Filter dryer
- 35 Filling
- 45 Vent valve
- 50 Temperature sensor
- 55 Pump
- 60 Flow monitor
- 61 Overpressure valve
- 65 Pressure relief valve
- 70 High pressure switch

**Layout diagram**



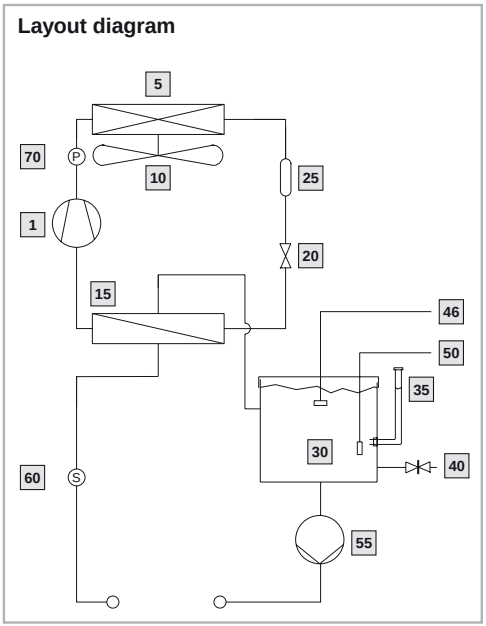

**Note:**
With an externally lockable cooling cycle, a bypass (overpressure valve) should be provided in the external water pipes.



### Recooling systems
**Open system**

**Key to the drawing opposite:**
- 1 Compressor
- 5 Condenser
- 10 Condenser fan
- 15 Evaporator coil
- 20 Expansion valve
- 25 Filter dryer
- 30 Tank
- 35 Filling
- 40 Tank drain
- 46 Water level switch, optional
- 50 Temperature sensor
- 55 Pump
- 60 Flow monitor
- 70 High pressure switch

**Layout diagram**




**Note:**
With an externally lockable cooling cycle, a bypass (overpressure valve) should be provided in the external water pipes.

## Recooling systems (for oil)

see Catalogue 31, page 613/614

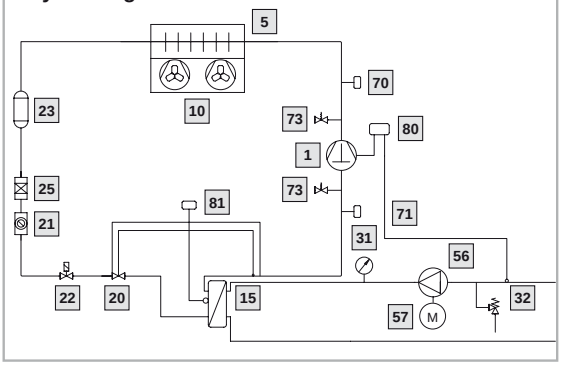
When cooling oil, particular requirements are placed on a recooling system.

The recooling systems for oil, equipped with a high-capacity geared pump, are designed as standard as once-through coolers without a tank, and ensure efficient cooling of the hydraulic oil that is heated during the course of the machining process.

**Key to the drawing opposite:**

- 1 Compressor
- 5 Condenser
- 10 Condenser fan
- 15 Evaporator coil
- 20 Expansion valve
- 21 Inspection glass
- 22 Magnetic valve
- 23 Liquid collector
- 25 Filter dryer
- 31 Manometer
- 32 Automatic bypass valve
- 56 Oil pump
- 57 Motor for oil pump
- 70 High-pressure switch
- 71 Low-pressure switch
- 73 Shut-off valve
- 80 Thermostat
- 81 Anti-frost thermostat

**Layout diagram**




## Immersible recooling systems

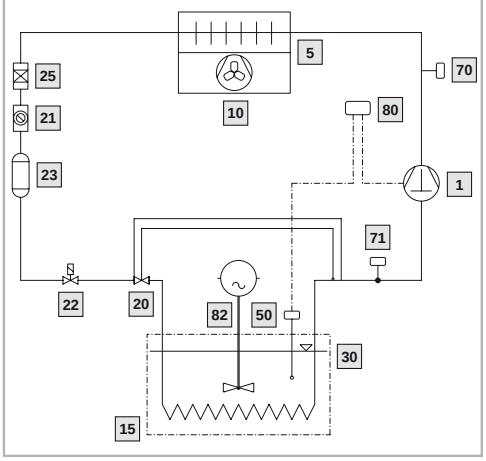
see Catalogue 31, page 618 – 623

Immersion recooling systems are used in all applications that require cooling of heavily contaminated media. Be it metal swarf or aggressive sludge, the high-quality flat evaporator coil of stainless steel and the closed cooling circuit ensure optimum cooling at all times.

**Key to the drawing opposite:**

- 1 Compressor
- 5 Condenser
- 10 Condenser fan
- 15 Evaporator coil
- 20 Expansion valve
- 21 Inspection glass
- 22 Magnetic valve
- 23 Liquid collector
- 25 Filter dryer
- 30 Tank, to be supplied by the customer
- 50 Temperature sensor
- 70 High-pressure switch
- 71 Low-pressure switch
- 80 Thermostat
- 82 Stirrer

**Layout diagram**

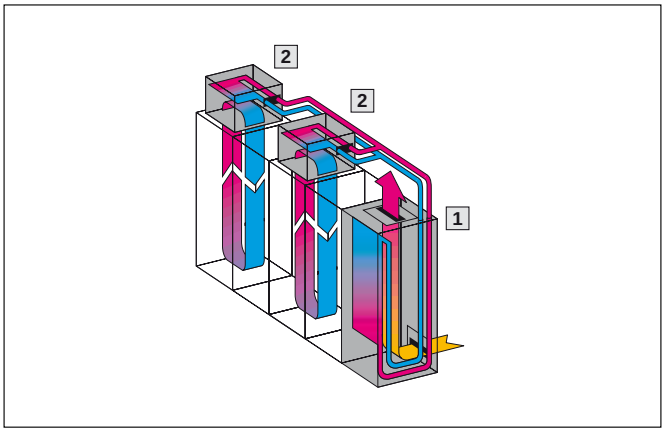


## Assembly

### Unity with enclosures

For example, recooling systems may be connected directly to a bayed enclosure suite, providing effective, centralised cooling for all enclosures and housings on a machine or system.

Recooling systems in the TS 8 Top enclosure system are easily integrated into existing enclosure combinations. For applications in confined conditions, the Mini-recooling systems for wall and roof mounting are ideal, with their space-saving, compact design.



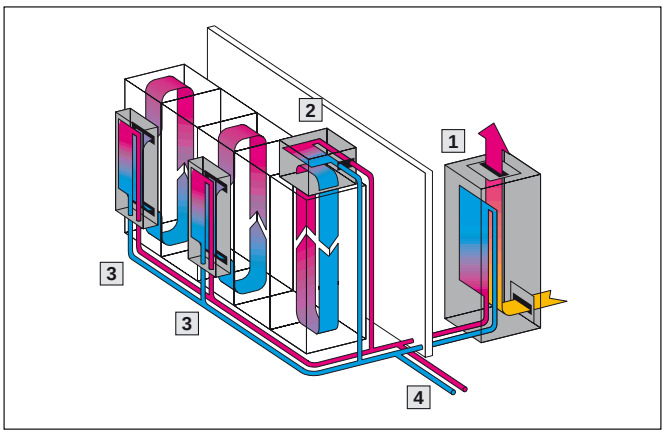

1 Recooling system
2 Air/water heat exchanger, roof-mounted



### Spatially separated

High heat loads can even be dissipated in confined and awkward spaces, thanks to the spatial separation of the recooling system from the enclosures and machine. In all cases, as well as enclosure cooling, cooling water may also be produced for process and machine cooling or for cooling liquid media.

Recooling systems in floor-standing and industrial enclosures, with their robust design, are the ideal stand-alone solution, and provide optimum service accessibility.

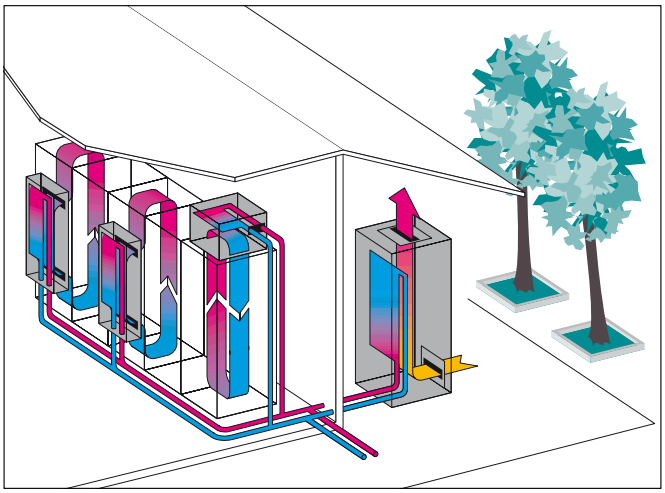



1 Recooling system
2 Air/water heat exchanger, roof-mounted
3 Air/water heat exchanger, wall-mounted
4 Other components, e.g. machine cooling

### Outdoor siting

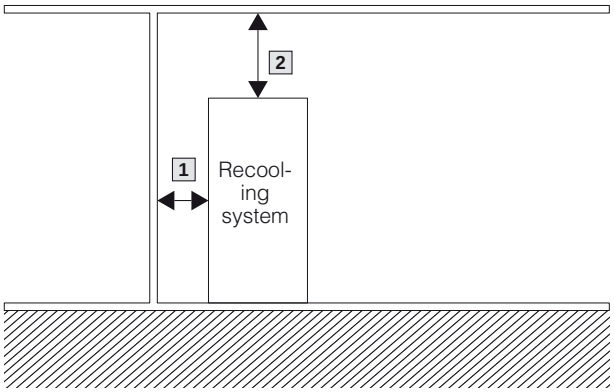
To avoid putting additional pressure on the factory air with the waste heat incurred during the process, the recooling system may be supplied with the option of outdoor siting (for ambient temperatures up to –20°C).

In such cases, a rain canopy should be provided to protect the recooling system from extreme weather. The water circuit must be filled with 34 % anti-freeze agent Antifrogen N (or equivalent) to 66 % water in relation to the total water volume.



## Assembly and commissioning

In the case of air-cooled recooling systems, the following minimum distances from the wall and ceiling should be observed:




1 Wall: At least 1x condenser height

2 Ceiling: At least 3x the condenser height

**When siting the recooling system, the following points should be observed:**

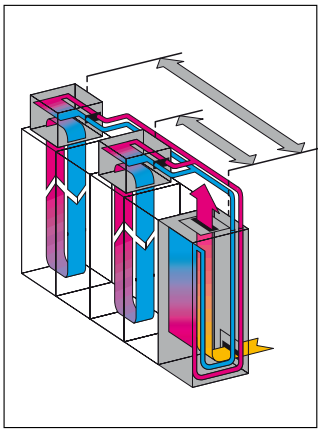
- Connection of an inlet and outlet duct shall require the manufacturer's prior consent.
  – Performance loss (air-cooled recooling system)
- Never site the recooling system in the vicinity of a heater.
  – Performance loss
- The recooling system may only be sited on flat, solid surfaces. The maximum permissible deviation from the vertical is 2°.
- Connect the equipment to the recooling system using insulated pipe or hose connections.
- If the equipment is positioned higher than the recooling system, install a non-return valve upstream in the inlet and a magnetic valve in the return.
  – To avoid overflowing the tank.
- With recooling systems that are intended for covered outdoor siting, the minimum external temperature is given in the technical specifications.
- In the case of recooling systems (for water) at temperatures below zero, a water/glycol mixture should be added in the prescribed ratio.
- If it is possible to shut off the equipment cycle, a bypass must be provided in order to protect the pump.
- Under no circumstances must the circulation pump be allowed to run dry.
  – Damage to the pump

5.4

## Distance from equipment

Site the recooling system close to the equipment in order to avoid long distances, which could lead to performance losses. When selecting the installation site, care should be taken to ensure easy access at all times; this will make maintenance of the system easier.

You should also ensure adequate ventilation of the room where the recooling system is sited. If there is inadequate ventilation, the temperature of the room will increase as a result of waste heat, leading to impaired performance of the recooling system.



## Cooling media

Apart from the recooling systems for oil and emulsion, all other recooling systems are only suitable for the cooling of water or a water/glycol mixture. When filling the systems for the first time, water from the existing supply line is generally suitable, although care should be taken to ensure a consistent water quality.

However, as satisfactory results are only rarely achieved without water treatment, additives should always be added to the cooling water, irrespective of the installation site. As well as protecting against frost, these also serve to impair bacterial growth and achieve optimum corrosion protection.

Pre-mixed additive is available from Rittal in the mix ratios
- 1 : 2 for outdoor siting,
- 1 : 4 for standard applications

in 10 l and 25 l containers.

See Catalogue 31, page 668.

## Benefits in brief !

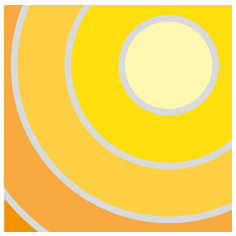
- **Individual project handling**
- **Project planning/ commissioning from a single partner**
- **Comprehensive pipeline calculation**
- **Global service network**

# Air/water heat exchangers

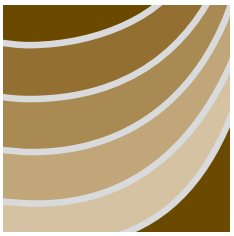
## Applications

Air/water heat exchangers effectively dissipate high heat losses. Thanks to the spatial separation of the heat exchanger and recooling system, the room is not burdened with waste heat.

## Ambient conditions



Heat



Dust



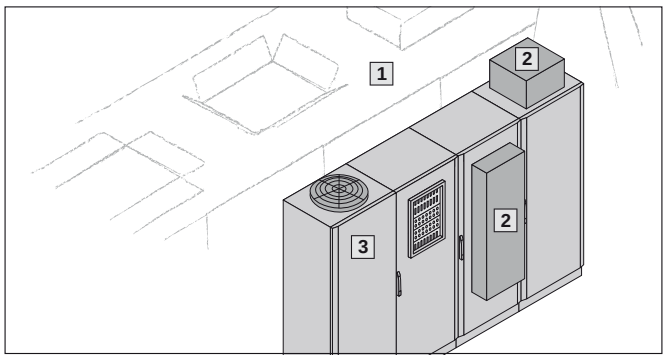
## Ideal at any installation site

High ambient temperatures and extreme levels of contamination are ideal conditions for the use of air/water heat exchangers. If direct dissipation of heat loss to the ambient air is undesirable or ineffective due to the confined space, the air/water heat exchanger may likewise offer an ideal solution. Very effective cooling solutions for individual enclosures or bayed enclosure suites may be achieved by separating the exchanger from the recooling system.

## Practical example of an air/water heat exchanger

In all areas with extreme ambient conditions, enclosure and climate control components are subject to special requirements. This applies, for example, to metal foundries, engine factories and the chemicals and metal-working industries.

In such situations, low-maintenance air/water heat exchangers are used as efficient all-rounders. Either fed from existing cooling water networks or from separate recooling systems, these products contribute to an ideal climate inside the enclosure. The cooling water absorbs the heat inside the heat exchanger and conveys it to the corresponding cooling system. In this way, even small rooms are exempt from additional waste heat from the enclosure, and the electronics inside the enclosure are effectively protected.




1 Extreme industrial environments

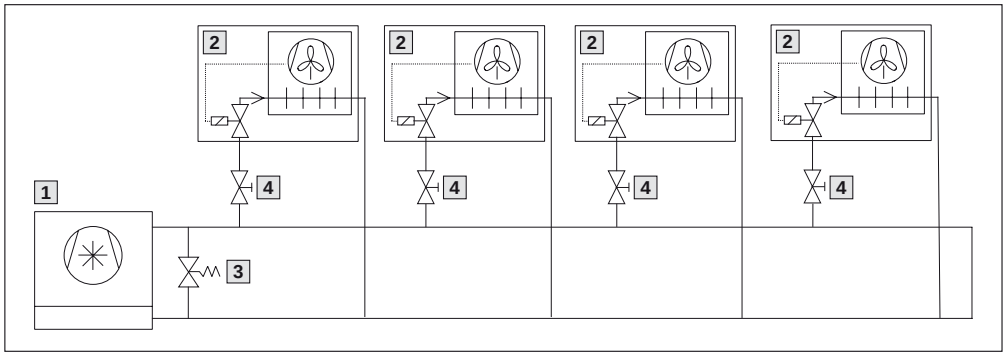
2 Air/water heat exchangers (roof-mounted, wall-mounted)

3 Recooling system

## Application example: Parallel connection of 4 air/water heat exchangers

Example: Parallel connection of air/water heat exchangers with cold water supply via a recooling system.

Overflow valves and bypass control should be integrated into the recooling system and the customer's own pipeline system respectively.




1 Recooling system

2 Air/water heat exchangers

3 Corner safety valve **SK 3301.900/.910/.920** (Bypass function with closed magnetic valve of the air/water heat exchanger)

4 Flow regulator valve **SK 3301.930/.940** (to regulate the volume flow in air/water heat exchangers)

## Roof or wall mounting

Two design variants for mounting on the enclosure roof or the side panel or door are available in the output range from 300 to 7000 watts. Available in two control variants (Basic and Comfort control), and also optionally with all water-carrying parts made from V4A (1.4571).

## High temperature range

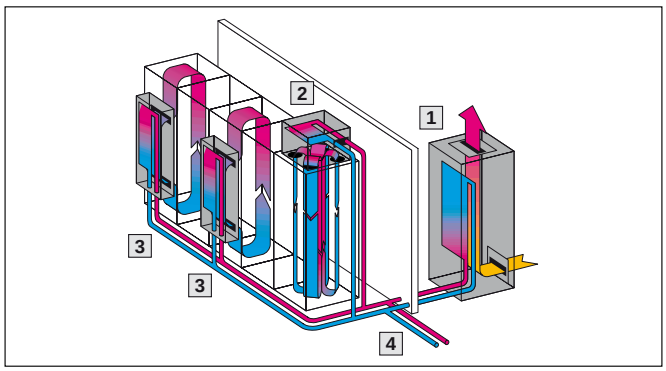
- Application areas with temperatures up to +70°C and extreme dust contamination, e.g. in foundries, are ideal for the use of this technology.
- Spatial separation of the heat exchanger and cold water supply is easily achieved.

1 Recooling system

2 Air/water heat exchanger, roof-mounted

3 Air/water heat exchanger, wall-mounted

4 Additional cooling water circuit for machine cooling




## Cooling medium quality requirements

For cooling media that cannot be precisely defined, or even seawater, air/water heat exchangers with all water carrying parts of stainless steel 1.4571 (V4A) are available.

General water quality requirements are outlined on page 29 “Hydrological data”.

## Assembly

### Application benefits

**Compact and lightweight**
Air/water heat exchangers have a low weight and a comparatively low volume in relation to the heat loss dissipated. As a result, they are easily mounted on vertical enclosure surfaces or on the roof.

**Air/water heat exchanger integrated into the side panel**
The side panel combines effective heat dissipation with minimum space requirements. It may be used in all 600 mm deep, 1800 mm/2000 mm high TS 8 enclosures.

**Virtually maintenance-free**
Because the ingress of ambient air into the heat exchanger is prevented, dirt is unable to penetrate. Control of the air and water circuit is electronically monitored.

### Sealing of the enclosure

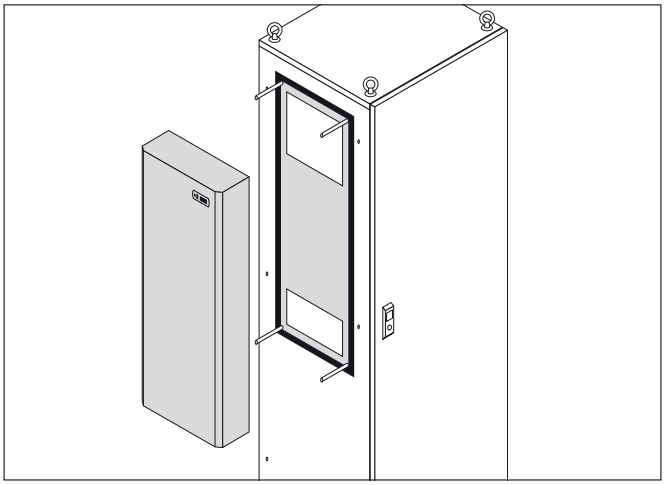


The enclosure must be sealed on all sides (IP 54). Particular attention should be paid to the sealing of the area around the cable entry openings and above all, the floor section of the enclosure.

Additionally, the door seal must be in perfect condition.

The sealing material enclosed with the heat exchangers must be applied in accordance with the installation instructions.

Take care not to bend the side panel or enclosure door.



### Installation on enclosures

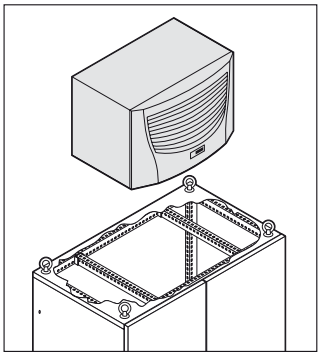
The heat exchanger must be correctly installed.

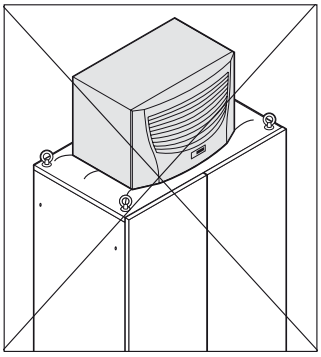
The roof plate of the enclosure must not be allowed to give under the weight of the heat exchanger.

If necessary, additional stays should be used. Do not obstruct the air inlets and outlets of the internal circuit.

**Note:**
For TopTherm roof-mounted units, TS 8 roof plates prepared with mounting cut-outs and reinforcement strips for all standard enclosure sizes are available as an accessory (Cat. 31, page 664).

When installing after the unit has been assembled, the twin-threaded bolts supplied loose should be screwed into the core holes in the plastic base on the underside of the device, with a maximum torque of 3 Nm.



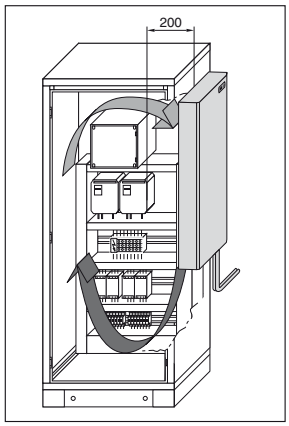


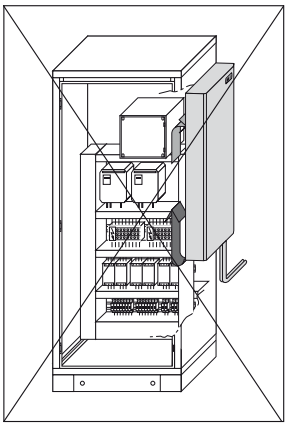
## Free air circulation

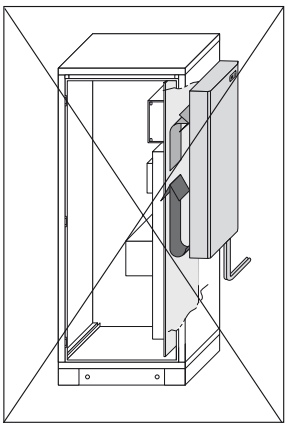
It is important to ensure “even” air circulation inside the enclosure. Air inlet and outlet openings in the internal circuit must on no account be obstructed by electrical installations. This would prevent air from circulating inside the enclosure. Under such conditions, the cooling capacity of the device would not be adequately utilised. A clearance of > 200 mm must be guaranteed.

**Note:**
Wall-mounted cooling units should never be fitted directly behind the mounting plate. Active power components are located on the front of the mounting plates. The heat exchanger would then operate in its own air short-circuit.

If it is impossible to install the device any other way, appropriate air baffle plates should be used, and air inlet and outlet openings should be provided in the mounting plate.



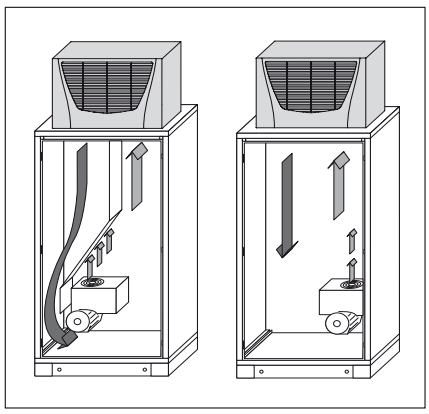



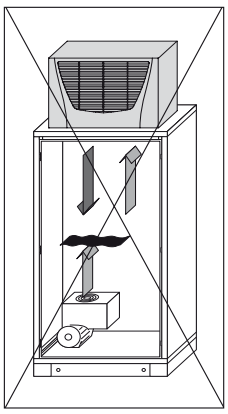




## Internal circuit – Roof-mounted units, flow conditions

When using roof-mounted units, particular attention should be paid to the air flow from the blowers of built-in electronic components such as frequency converters and other drive units.





## Air routing

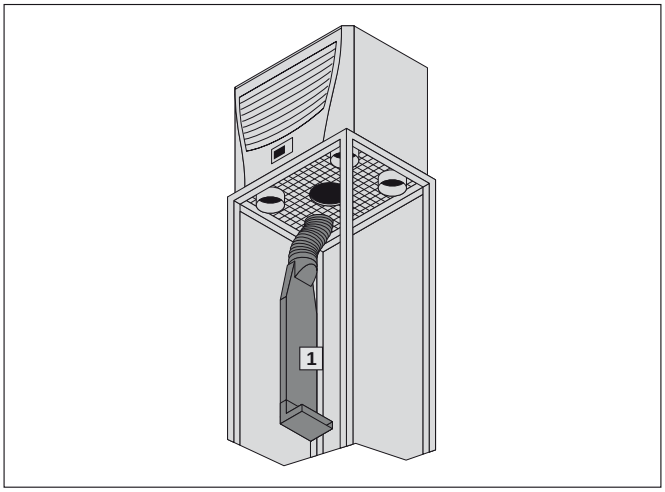
### Air-ducting system

**for TopTherm roof-mounted air/water heat exchanger**

With the air duct system, it is possible to route the cold air directly to specific areas of the enclosure. This effectively eliminates the risk of “short circuits” in the air circulation due to self-ventilated components.

**Note:**

- Never direct the cold air flow straight at active components.
- Route the air duct system directly downwards with no bends.
- Cold air must be able to escape unobstructed at the end of the duct.
- Additional deflections will reduce the useful cooling output.
- When using the ducting system, the performance of the heat exchanger may be reduced, depending on the respective application.
- The air duct system should not be extended.




**Accessories:**

1 Air duct system for roof-mounted units, see Cat. 31, 658.

### Stopper

**for TopTherm roof-mounted air/water heat exchanger**

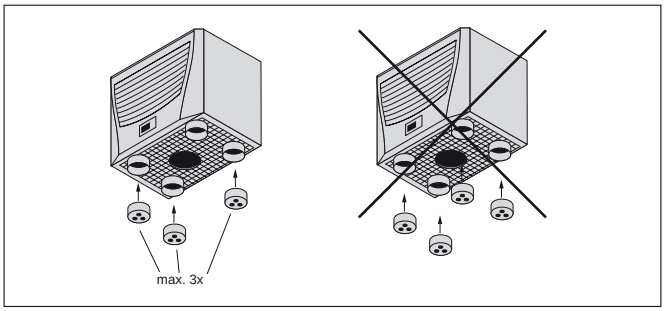
For sealing any cold air outlets that are not required.

**Note:**

At least one outlet opening must always remain open!

Please note that if two or three openings are closed, the cooling output may be reduced by 20 % and 30 % respectively!

**SK 3286.880** for units
SK 3209.xxx
SK 3210.xxx




### Internal circuit – Wall-mounted units, flow conditions

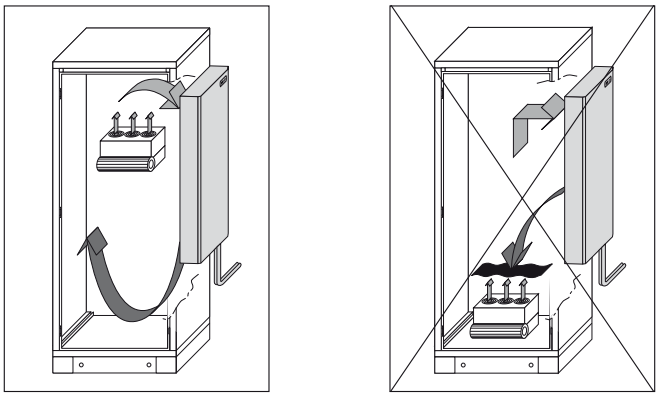
Attention should be paid to components/electronic components equipped with their own ventilation systems, such as blowers and axial fans. If their air flow is directed against the chilled air flow of the heat exchanger, this could cause an air short-circuit and prevent adequate climate control. In a worst case scenario, the heat exchanger will suffer an air short-circuit.

**Note:**

Never direct the chilled air flow at active components.

**Accessories:**

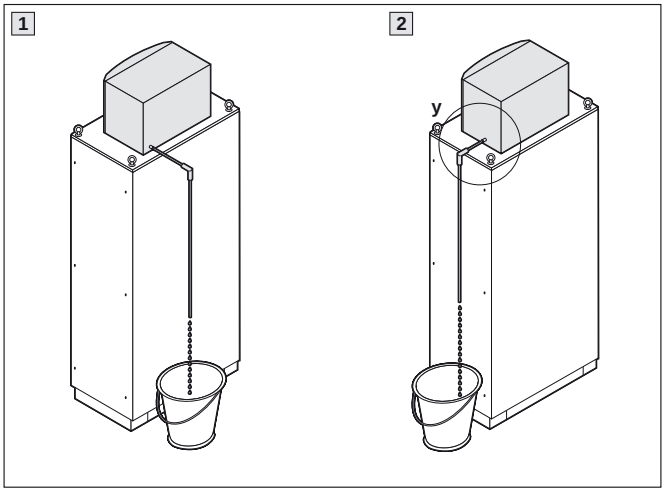
Air diverter, see Cat. 31, page 659.

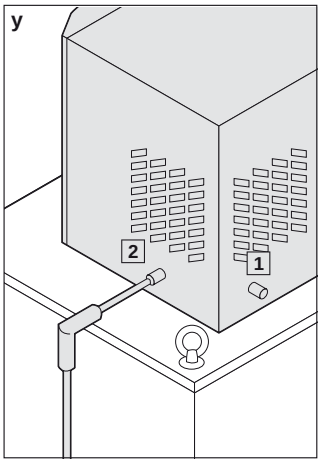


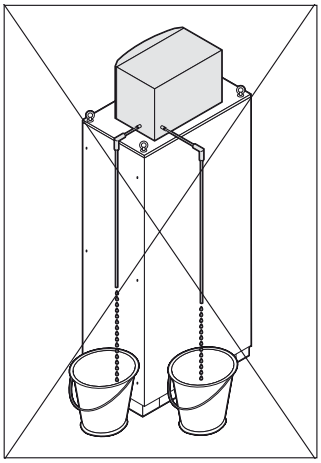
## Condensate routing (roof-mounted units)

Any condensation which forms on the heat exchanger (with high humidity and low enclosure interior temperatures) is routed to the right and/or downwards out of the device via a drain in the tray. For this purpose, a piece of hose should be connected to one of the two condensate nozzles (1 or 2). **The drain which is not required should be tightly sealed. The condensate must be able to run off freely. If the condensate is to be drained off over a greater distance, then care must be taken to ensure that the hose is free from kinks** and checked for correct drainage. Units with a Comfort controller are additionally equipped with a condensate alarm.

1 Condensate discharge rear
2 Condensate discharge right



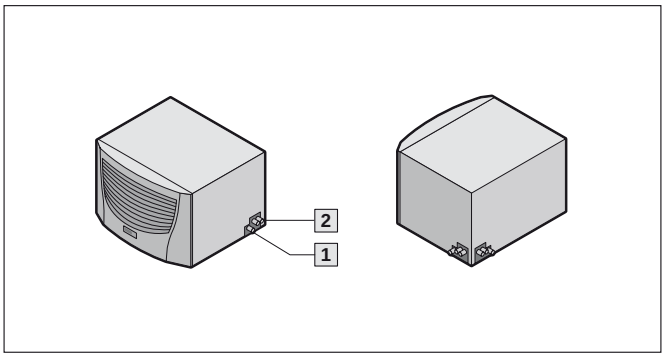



## Flexible cooling water connection and condensate drain pipe

**Roof-mounted units:**
In its delivered state, hose nozzles for connecting the cooling water and condensate hoses are located on the right-hand side of the unit. There is a second connection point for cooling water and condensate at the rear of the unit, which is sealed with sealing caps. If the connections at the rear are used, the sealing cap and hose nozzle should be unscrewed, cleaned and **resealed** using standard commercially available sealant (Teflon tape or hemp with sealing paste). Next, screw in the three sealing caps on the right and the three hose nozzles at the rear of the unit with the following torques:

- 15 Nm for hose nozzles for the supply and return flow
- 15 Nm for sealing caps for the inlet and return
- 2 Nm for condensate discharge
- 2 Nm for sealing caps for condensate discharge

**Note:**
Any condensate arising is discharged via the $^{1}/_{2}$″ tube connector and a discharge hose, which should be laid with a gradient ensuring that there are no kinks. In order to avoid increased condensation, the cooling water temperature should be adapted to match the required cooling output. Any condensate occurring may be disposed of using an external electronic condensate evaporator.

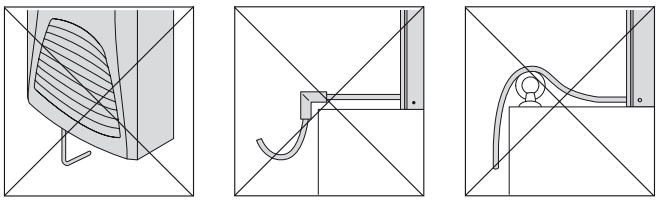



1 Condensate discharge (flexible)
2 Cooling water connection (flexible)

## Condensate management

### Note:
### Condensate discharge (wall-mounted units)

For wall-mounted units, a hose should be connected to the condensate nozzle on the bottom of the unit.

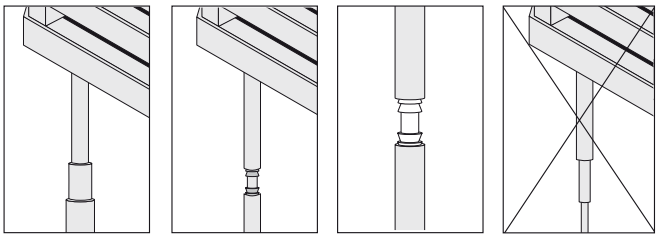


The condensate drain pipe should be laid with a gradient, taking care to ensure there are no kinks in the pipe!

## Condensate discharge

If the condensate discharge is extended, its cross-section must not be reduced.

**Accessories:**
PVC condensate hose

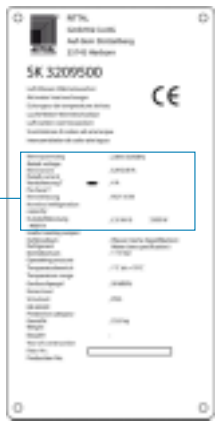


| Condensate hose | For unit(s) |
|---|---|
| SK 3301.612 (12 x 2) | SK 3209.xxx/SK 3210.xxx<br>SK 3364.xxx/SK 3373.xxx<br>SK 3374.xxx/SK 3375.xxx |

## Supply connection

- Supply connection data (voltage and frequency) must be observed in accordance with the rating plate.
- The pre-fuse specified on the rating plate must be used.

| | | |
|---|---|---|
| Rated voltage | 230 V 50 Hz/60 Hz | |
| Rated current | 0.4/0.48 A | |
| Pre-fuse T | 4 A | |
| Power consumption | 95/110 W | |
| Useful cooling output 400 l/h | L 35 W10 | 2500 W |
| Cooling medium | Water (see specifications) | |



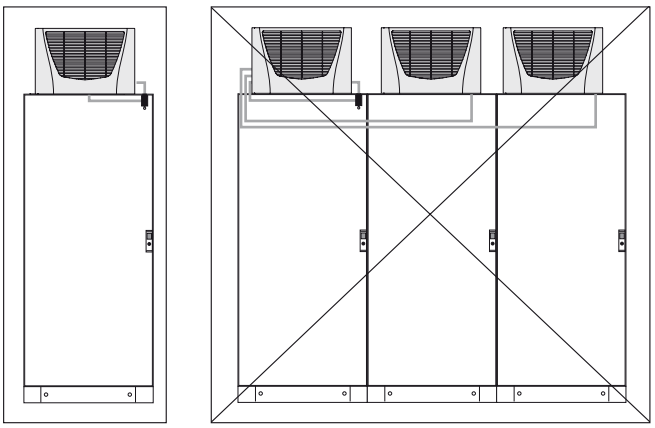


## Use of door-operated switches

One floating door-operated contact should be used for each unit; under no circumstances must several air/water heat exchangers be operated via one door-operated switch.

In environments with increased electromagnetic interference, a shielded cable should be used.
Alternatively, the door contact may be switched e.g. via an additional relay in the vicinity of the air/water heat exchanger.

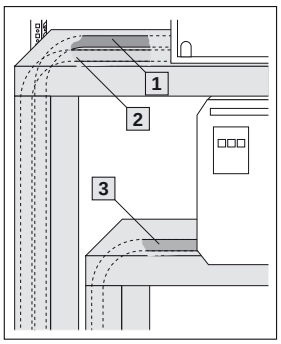
**Note:**
The cables should be laid separately from the mains cables; short cable distances should be observed.

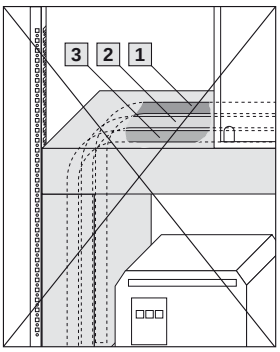


## Cabling

1 Signal data cable
2 Control cable
3 Motor cable

The power cable, power supply unit cable, signal cable and data cable must be laid separately; cable lengths should be kept as short as possible. Avoid coupled sections.



## Electrical connection and control

### Intelligent control

The two controller variants for operational reliability offer a comprehensive range of functions. Essential control electronics are well protected and cooled in the inner circuit.

**Both variants have the following properties:**

- Three voltage options: 115 V, 230 V, 400/2 ~
- Integral start-up delay and door limit switch function
- Leakage monitoring
- Monitoring of all motors

**Basic controller:**

- Visualisation of the operating status via LED display:
  – Voltage applied, functions OK
  – Door open
  – Overtemperature
- Switching hysteresis: 5 K
- Floating fault signal contact in case of overtemperature
- Setpoint externally adjustable via potentiometer (setting range 20 – 55°C)



**Comfort controller:**

- Master / slave function for up to 10 units, i.e. the unit which reaches the setpoint first reports this to the “master”, which switches all the other “slaves” on and off. The unit in which the door limit switch function is activated reports this to the “master”, which deactivates all the “slaves”.
- Switching hysteresis: 2 – 10 K; preset to 5 K
- System alarm, individually configurable for 2 floating fault signal contacts
- Visualisation of the current enclosure internal temperature and all system messages on the display
- Storage of all system statuses in the log file
- Optional extension card **(SK 3124.200)** with RS 232, RS 485, RS 422 and PLC interface for integration into superordinate remote control systems, e.g. with CMC, is also possible

## Benefits

The air of the enclosure interior may also be cooled to below the level of the external temperature, if required, by using cooling water from a central recooling system.

The ingress of dust from outside into the cooled enclosure is prevented. The waste heat from the enclosure does not raise the temperature of the ambient air, provided the heat exchanger and cold water supply system are spatially separated from one another.

### Useful cooling output from 300 to 7000 watts

in three mounting variants:

- Wall mounting
- Roof mounting
- Integrated into the TS 8 side panel. This installation form uses the space behind the side panel of the TS 8.

### Central cooling as cold water supplier

By integrating the air/water heat exchangers into an existing cooling water circuit or connecting to a central recooling system, the necessary heat loss can be dissipated with exceptionally low energy costs.

### Effective in extreme conditions

Air/water heat exchangers may even be used in particularly extreme ambient temperatures from +1° to +70°C. Even extreme levels of contamination in the ambient air, e.g. with dust and oil, do not affect functioning. High heat losses are dissipated in the most confined spaces, without emitting them directly to the ambient air. A high operating ratio is achieved, thanks to the large surface area of the heat exchanger unit.

### Benefits in brief !

- **Useful cooling output from 300 to 7000 watts**
- **Suitable for use even under extreme conditions and ambient temperatures of up to +70°C**
- **Also available with all water-carrying parts made from V4A**
- **System for TS 8 integrated into the side panel**
- **High protection category.**
  **Thanks to the sealed design, a protection category of IP 55 to EN 60 529/10.91 is achieved.**



### Leak monitoring of roof-mounted units

In order to ensure that the enclosure interior is not at risk from cooling water, the sensor reports a leak in the event of water in the corrosion-resistant base tray.

**Safety instructions**

- When installing the device, the condensate discharge must be routed out of the enclosure!
- In order to avoid frost damage, the minimum permissible water temperature of +1°C must not be undercut at any point in the water cycle!
- Always obtain the manufacturer's consent before adding anti-freeze agent!
- During storage and transportation below freezing point, the water cycle should be drained completely using compressed air!
- Only set the temperature as low as is strictly necessary, since undercutting the dew point with a falling water inlet temperature will result in condensation!
- It is very important that the enclosure is sealed on all sides (IP 54), particularly the cable entry (condensation)!

### Important

- Air/water heat exchangers are always used in conjunction with recooling systems or a cooling water cirucuit

**For calculation formulae and water quality requirements, see page 29 or refer to our website: www.rittal.com**

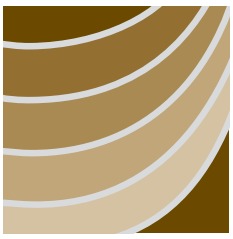
# Air/air heat exchanger

## Applications

Air/air heat exchangers use the external temperature for cooling. By separating the internal and external air circuits, the ingress of dust into the enclosure is prevented.

### Ambient conditions

Cool



Dust

## Outstanding performance and design

The requirement for use of air/air heat exchangers is that the ambient temperature must be below the required enclosure internal temperature.
Dust and aggressive ambient air are unable to enter the enclosure interior, thanks to the two separate air circuits.

In all situations where the ambient air is sufficient for cooling, air/air heat exchangers offer effective, energy-saving solutions. The high specific thermal output is attributable to the special construction and functional design of the heat exchangers:

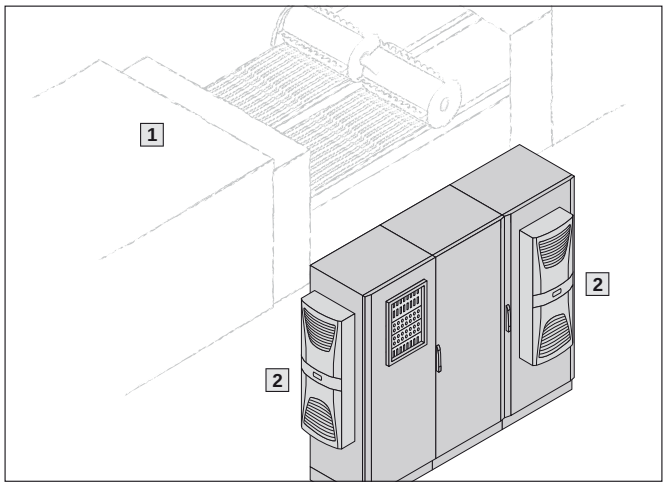
- A large heat exchanger area with compact dimensions
- Exceptionally conductive materials and connections
- Fans that may be controlled separately
- Optimum flow conditions

7.1

## Practical example of an air/air heat exchanger

In the paper and wood-processing industries, for example, particular requirements are placed on climate control components. They ensure good internal ventilation and heat dissipation from the enclosure. At the same time, they also prevent the ingress of super-fine dusts.

Air/air heat exchangers are ideal for this purpose, since they effectively dissipate the heat from the enclosure with their two hermetically separate air circuits based on the reverse current or counter-current principle, and prevent the ingress of ambient air into the enclosure.




1 Wood-processing industry

2 Air/air heat exchanger (wall-mounted)

## Cool ambient air

Air/air heat exchangers utilise the ambient air to cool the air in the enclosure interior. Based on the counterflow principle, the completely separate airflows are routed through the heat exchanger module by powerful fans.

- Ambient conditions: The ambient temperature $T_u$ must be lower than the permissible enclosure interior temperature. A temperature difference of 10 K is ideal.
- Also ideal for use in dusty ambient conditions.

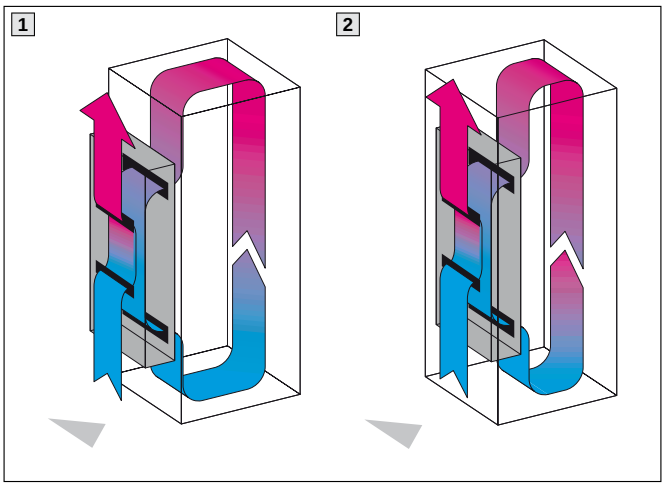
## Flow and siting conditions

### Internal/external mounting

Air/air heat exchangers may optionally be mounted on the outside or inside of the enclosure. The slimline design facilitates external mounting on the door, rear panel and side panels. The range also includes a special heat exchanger for roof-mounting.

By diverting the waste air upwards, this prevents the creation of disruptive air flows in front of the enclosures.

The fans in the internal and external circuit may be activated separately and thus adapted ideally to the ambient conditions.




1 External mounting

2 Internal mounting

## Assembly

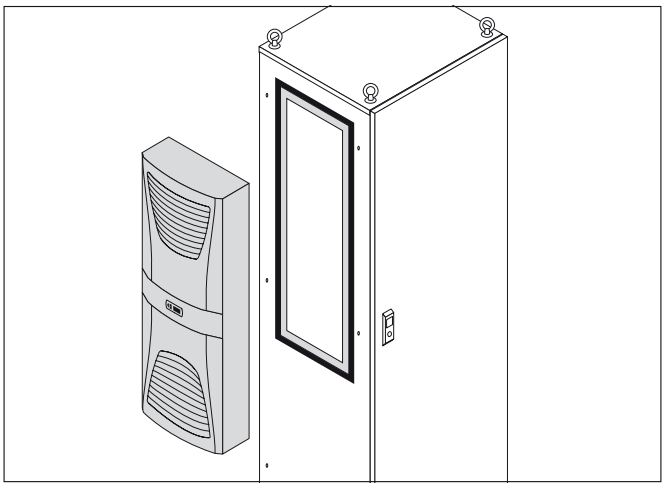
### Sealing of the enclosure

The enclosure must be sealed on all sides (IP 54). Particular attention should be paid to the sealing of the area around the cable entry openings and above all, the floor section of the enclosure.

Additionally, the door seal must be in perfect condition.

The sealing material included with the heat exchangers must be applied in accordance with the installation instructions.

Take care not to bend the side panel or enclosure door.



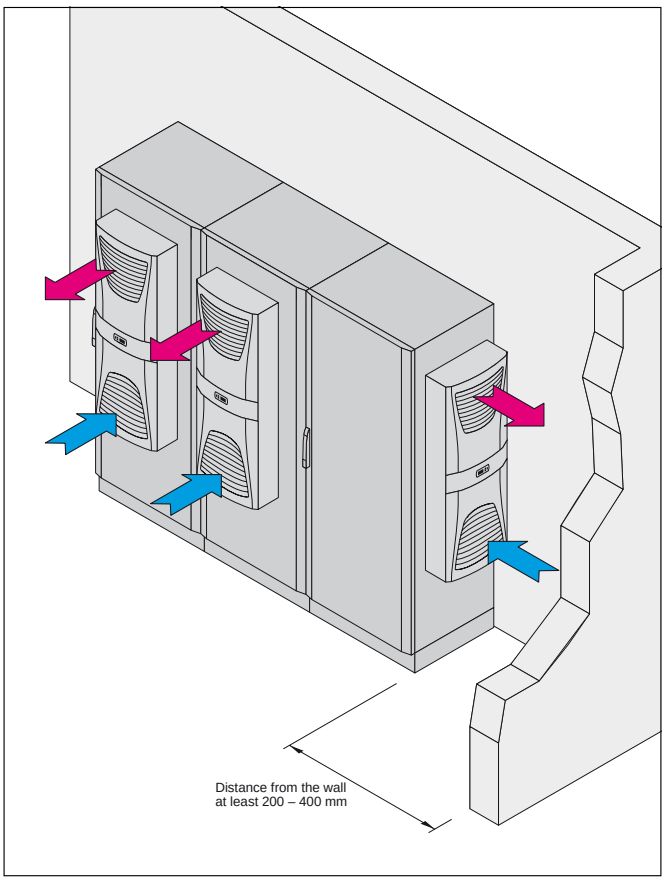


### External circuit
### Flow and siting conditions

In the outer circuit, air/air heat exchangers should be spaced 200 – 400 mm from the wall and/or from each other (air inlet and outlet openings).
If this clearance cannot be maintained, air baffle plates will need to be used.

#### Siting options

Wall-mounted heat exchangers may be mounted on the rear panel, side panels or door of the enclosure.

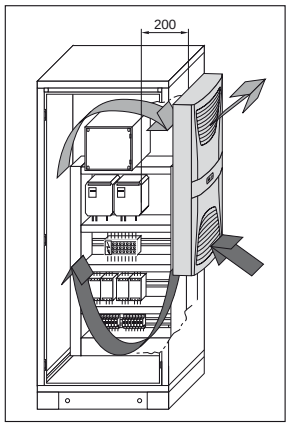


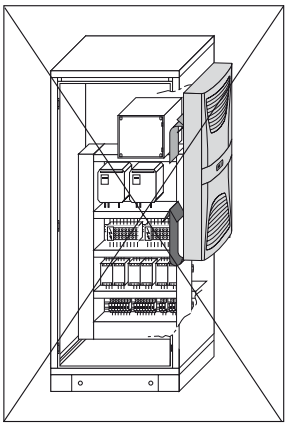
## Free air circulation

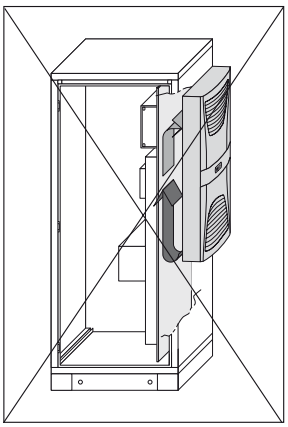
It is important to ensure “even” air circulation inside the enclosure. Air inlet and outlet openings in the internal circuit must on no account be obstructed by electrical installations. This would prevent air from circulating inside the enclosure. Under such conditions, the capacity of the device would not be adequately utilised. A clearance of > 200 mm must be guaranteed.

**Note:**
Wall-mounted cooling units should never be fitted directly behind the mounting plate. Active power components are located on the front of the mounting plates. The heat exchanger would then operate in its own air short-circuit.

If it is impossible to install the device any other way, appropriate air baffle plates should be used, and air inlet and outlet openings should be provided in the mounting plate.



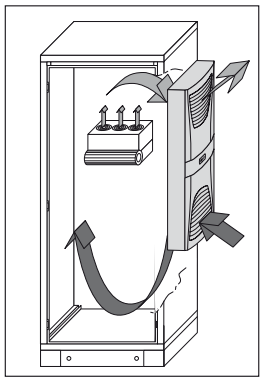


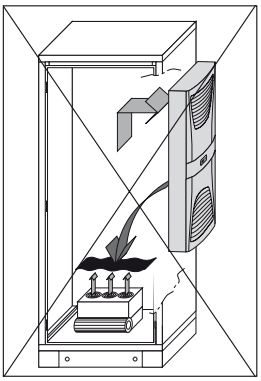


## Internal circuit – Wall-mounted units

Attention should be paid to components/electronic components equipped with their own ventilation systems, such as blowers and axial fans. If their air flow is directed against the chilled air flow of the heat exchanger, this could cause an air short-circuit and prevent adequate climate control. In a worst case scenario, the heat exchanger will suffer an air short-circuit.

**Note:**
Never direct the chilled air flow at active components.





## Electrical connection and control

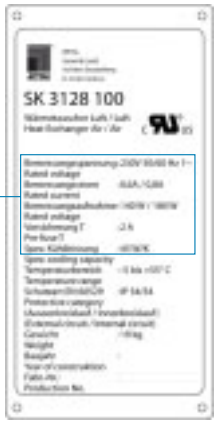
### Simple control with digital temperature indicator

- Specific thermal output from 17.5 to 90 W/K
- With controller and digital temperature indicator
- Floating fault signal contact in case of overtemperature
- System analysis via display

### Supply connection

- Supply connection data (voltage and frequency) must be observed in accordance with the rating plate.
- The pre-fuse specified on the rating plate must be used.

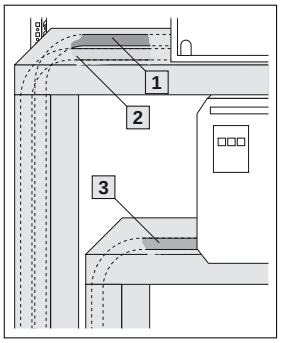
| | |
|---|---|
| Rated voltage | 230 V, 50/60 Hz |
| Rated current | 0.6 A/0.8 A |
| Rated consumption | 140 W/180 W |
| Pre-fuse T | 2 A |
| Specific cooling output | 45 W/K |

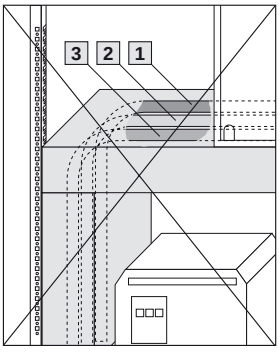



### Cabling

1 Signal data cable
2 Control cable
3 Motor cable

The power cable, power supply unit cable, signal cable and data cable must be laid separately; cable lengths should be kept as short as possible. Avoid coupled sections.



## Benefits

The requirement for using air/air heat exchangers is that the ambient temperature must be below the required enclosure internal temperature.

Dust and aggressive ambient air are unable to enter the enclosure interior, thanks to the two separate air circuits.

### Service/assembly

**Simple maintenance**
The heat exchanger unit is very easily removed and cleaned. The cleverly designed layout facilitates time-saving, cost-cutting maintenance.

**Easily retrofitted**
Thanks to the low weight, simple assembly cut-outs and problem-free attachment of the heat exchangers, a cabinet or enclosure is easily retro-fitted.

Optionally external or internal mounting.

### Safety

**High protection category**
Thanks to the seamlessly sealed heat exchanger module, a protection category of IP 54 to EN 60 529/10.91 is achieved.

**High load capacity**
The motors of the fans are equipped with thermal winding protection.

**Top quality: Guaranteed protection for your electronics.**
All devices in the Rittal TopTherm series are tested in accordance with the internationally valid approvals (GS, UL).

### Benefits in brief !

- **Specific thermal output from 17.5 W/K to 90 W/K**
- **Temperature-controlled fan**
- **Mounting cut-outs and enclosure dimensions identical to TopTherm wall-mounted cooling units**
- **Suitable for external and internal mounting**
- **Top design, identical to TopTherm wall-mounted cooling units**

### Important

- The temperature difference between the room temperature and enclosure internal temperature will have a decisive effect on the heat loss that may be dissipated.

**For calculation bases see page 30 or refer to the Internet at www.rittal.com**

# Fan-and-filter units

## Potential applications/selection critiera

Fan-and-filter units utilise the ambient air for direct cooling of the enclosure interior.

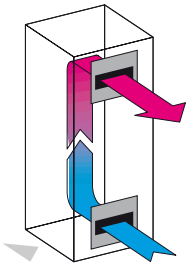
This requires cool, reasonably clean ambient air.

### Ambient conditions

Cool

## Application diversity and design

In most cases, it makes sense to install the axial fan with the air directed from outside into the enclosure so that **over-pressure** is created inside the enclosure, as per the delivered state. This helps to avoid the ingress of unfiltered ambient air.

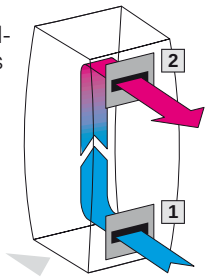


**Advantage: Aesthetics and function**
Typical of the Rittal fan-and-filter unit design is the extremely low build height. The super-slimline vent grille guarantees optimum air throughput with low noise generation. Combined with the technical features, Rittal fan-and-filter units meet all application requirements.

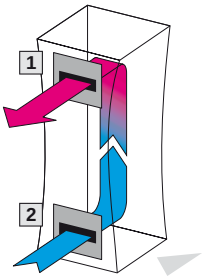
Fan-and-filter units are ideal for dissipating heat loads cost-effectively. The pre-requisite is that the ambient air must be relatively clean and with a temperature below the desired enclosure internal temperature. The entire range of fan-and-filter units is now also available with EMC shielding and all required rated voltages.

## Air direction

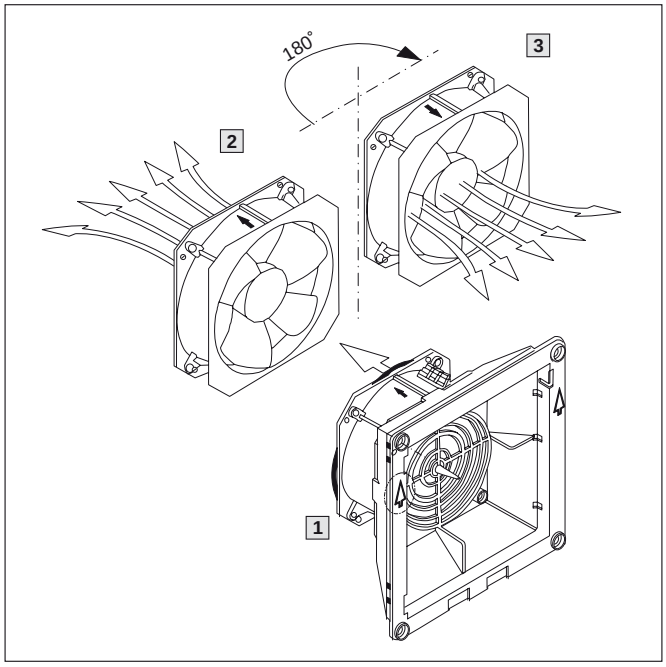
Air flow **“blowing into the enclosure”.** Standard arrangement of fan and outlet filter. In this case, a minimal overpressure is generated inside the enclosure. The incoming air is routed completely via the filter mat.




Air flow **“sucking out of the enclosure".** Configuration after changing the airflow direction of the fan-and-filter motor. In such cases, unfiltered "bad air” may be drawn in via leaks in the enclosure.




1 Fan-and-filter unit
2 Outlet filter




1 Dismantling
2 Direction of air flow in the supplied state/standard
3 Direction of air flow after rotating the fan motor

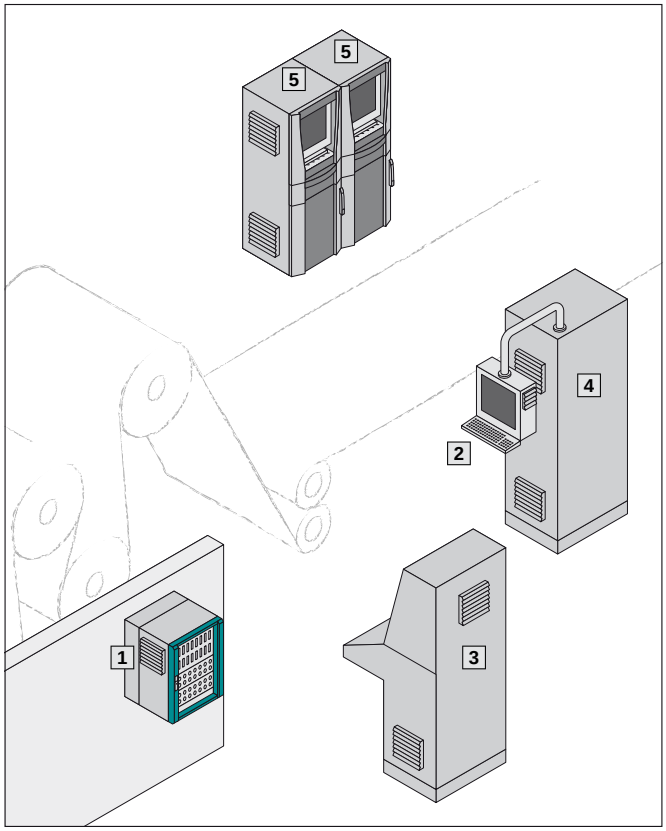
## Practical example of a fan-and-filter unit

Fan-and-filter units are used in virtually all segments of industry: from the smallest enclosures, to command panels and consoles, through to large and bayed enclosure systems. They are the easiest method of protecting against overheating and hotspots.

The basic pre-requisite for their use is that the ambient temperature must be significantly below the enclosure internal temperature.

A wide range of control units such as thermostat, hygrostat and speed control for noise minimisation extend the applications e.g. to include the office sector and laboratories.

EMC fans meet the requirements for increased RF shielding. Particularly when using fan-and-filter units in conjunction with PC enclosures or monitor panels, DC variants are used which provide effective protection from interference.




1 Small enclosure
2 Command panel
3 Console
4 Bayed enclosure/large enclosures
5 PC enclosure



## Sealed and shielded

**Also available with EMC shielding**
All fan-and-filter units and outlet filters are alternatively available with EMC shielding. The required conductive connection is achieved via a metallic coating on the fan-and-filter unit housing and a special sealing frame.

**Protection functions**
The membranes of the fan grille in the form of a **rain canopy** provide exceptional protection against the ingress of splashed water and dust.
**Protection category IP 54** is achieved as standard.

**Hosed water protection**
Particularly for applications in the food industry, the hose-proof hood prevents the ingress of damp. The protection category IP X5 is achieved in conjunction with additional fine filter mats.

**Important**
- The prescribed heat loss and the maximum anticipated ambient temperature define the required volumetric flow
- Always use the fan-and-filter units and outlet filters together

**Calculation formulae, see page 30 or refer to the Internet at www.rittal.com**

## Assembly

### Benefits of Rittal fan-and-filter units and outlet filters

- All-round foamed-in seal as standard to achieve a protection category of IP 54
- Additional mounting catches for fast, screwless assembly, to ensure secure attachment to the enclosure
- A new unlatching system for removal of the louvred grille

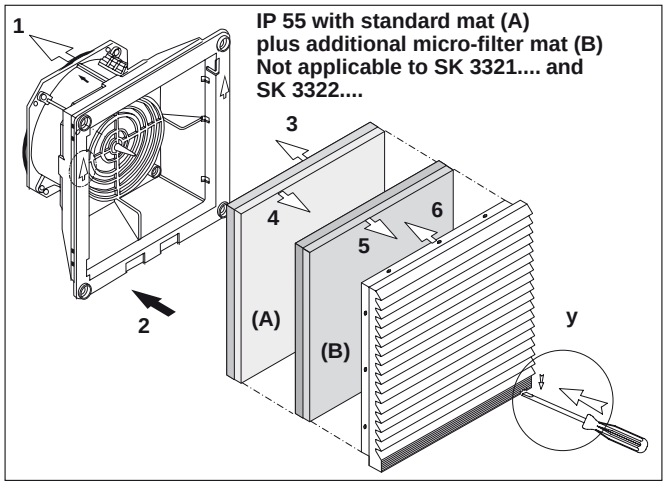
Super-simple assembly without screws

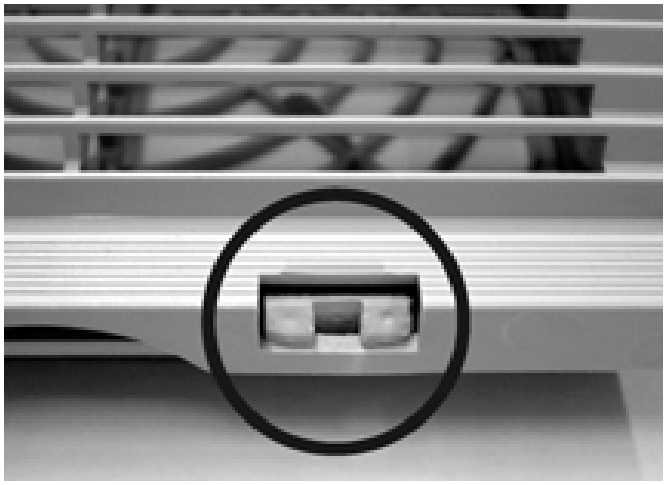
**Benefits:**

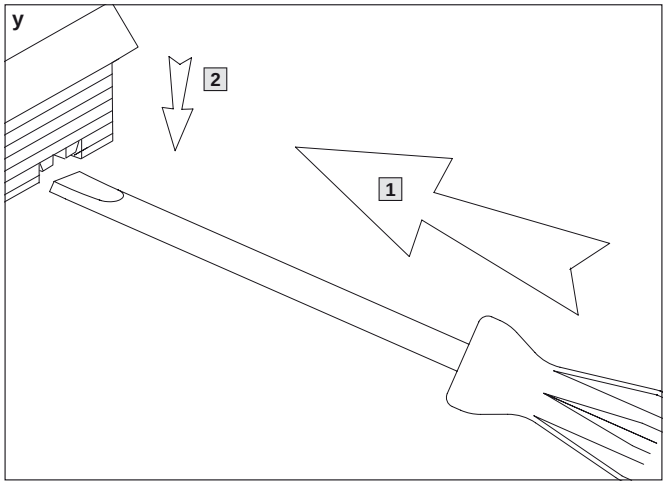
- Air throughput from 20 to 700 $m^3/h$
- Super-fast assembly
- Air flow direction may be reversed from extracting (standard setting) to blowing
- All fans also available with EMC shielding

### Louvred grill lock system

- Can **only be opened with tools**
- Achieves a protection category of **IP 55** with types SK 3323. ... to SK 3327. ...





## Benefits

Fan-and-filter units are ideal for dissipating heat loads cost-effectively. The pre-requisite is that the ambient air must be relatively clean and with a temperature below the desired enclosure internal temperature.

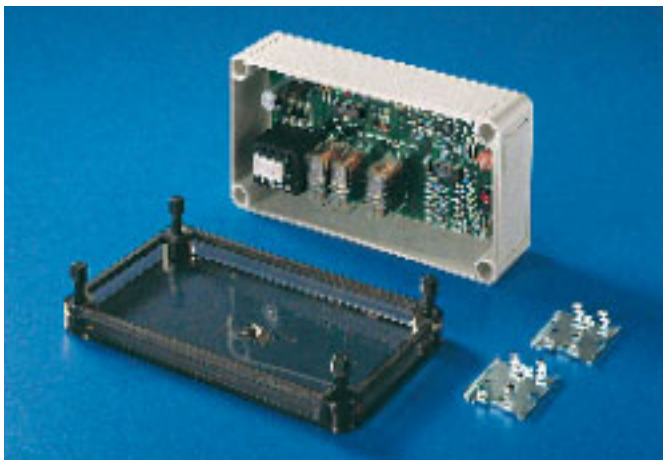
The entire range of fan-and-filter units is now also available with EMC shielding and all required rated voltages.

**Aesthetics and function**
Typical of the Rittal fan-and-filter unit design is the extremely low build height. The super-slimline vent grille guarantees optimum air throughput with low noise generation. Combined with the technical features, Rittal fan-and-filter units meet all application requirements.

### Benefits in brief !

- **Air throughput from 20 $m^3/h$ to 700 $m^3/h$**
- **Super-fast assembly**
- **IP 54 as standard**
- **Reversing the direction of air flow. Air flow direction may be reversed from extracting (standard setting) to blowing**
- **All fans also available with EMC shielding**





**Not always full power!**
At lower ambient temperatures, the air throughput may be reduced. By adapting the fan-and-filter speed to match the temperature using a controller, noise generation is reduced.

### Important

- The prescribed heat loss and the maximum anticipated ambient temperature define the required volumetric flow
- Always use the fan-and-filter units and outlet filters together

**Calculation formulae, see page 30 or refer to the Internet at www.rittal.com**

# Enclosure heaters

## Applications

Heaters evectively prevent the formation of hazardous

leakage current caused by condensation.

### Ambient conditions

Cool

Damp

Enclosure heaters are used to prevent the formation of condensation inside the enclosure and maintain a constant minimum operating temperature (e.g. when the system is switched off overnight). They achieve thermal outputs of 10 to 1000 watts.

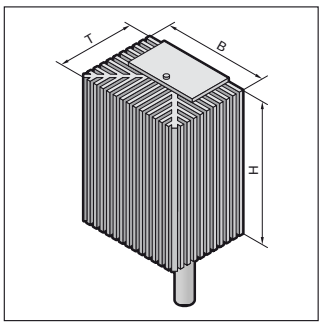
Modern enclosure heaters are equipped with PTC elements. By virtue of their characteristic curve, these are self-regulating.

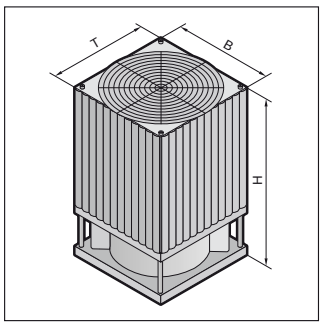
From an energy and environmental viewpoint, it is nevertheless advisable to use either a thermostat or hygrostat, or possibly both together, depending on the application, for control purposes. If both are used, both control devices activate the heater via a contactor.

9.1

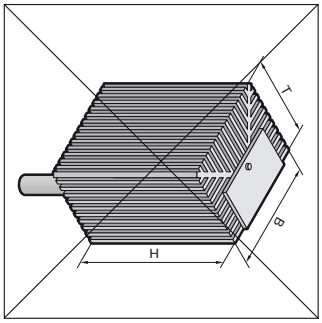
## Installation position

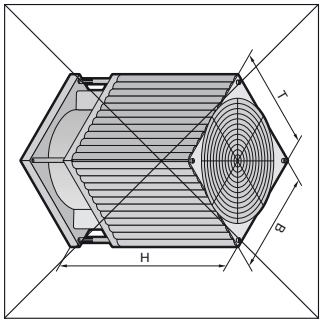
Heaters should always be installed in an upright position. Leave a distance of 50 mm at the top and bottom to allow convection



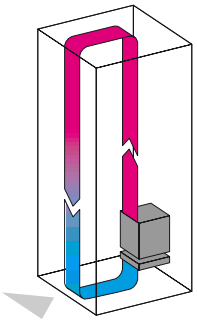




effective



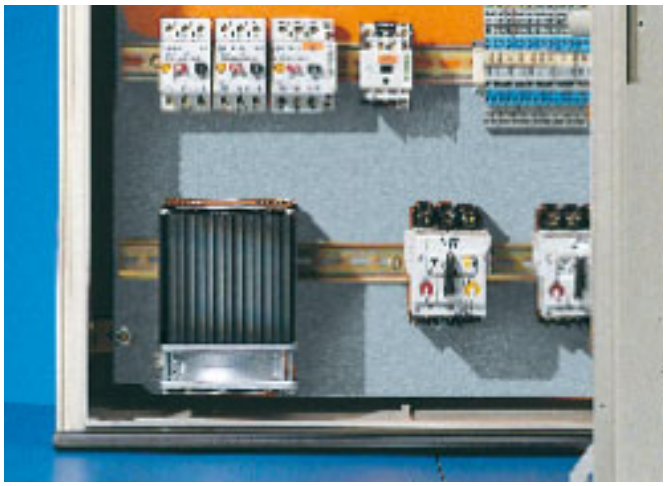




ineffective



Flow circuit
Installation position

**Installation option for the enclosure heaters**
The device is attached vertically, i.e. with the connection cable pointing downwards. The connection cable should be tightly secured. In order to create the required convection, a distance of at least 50 mm from components must be maintained above and below the device. The thermal safety clearance from neighbouring components is at least 35 mm. Provided these clearances are adhered to, an ambient temperature of 65 °C will not be exceeded.

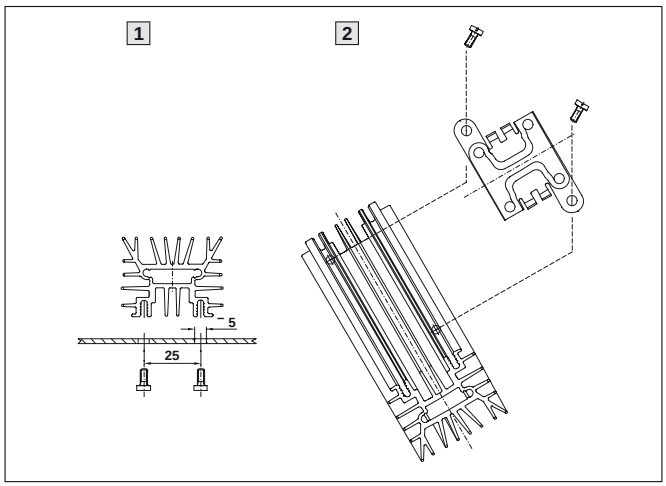


**Installation versions:**

1 Direct screw-fastening to the mounting plate
(screw-fastened from the rear through the mounting plate)

2 Direct snap-mounting onto the C rail

This facilitates easier, faster mounting.



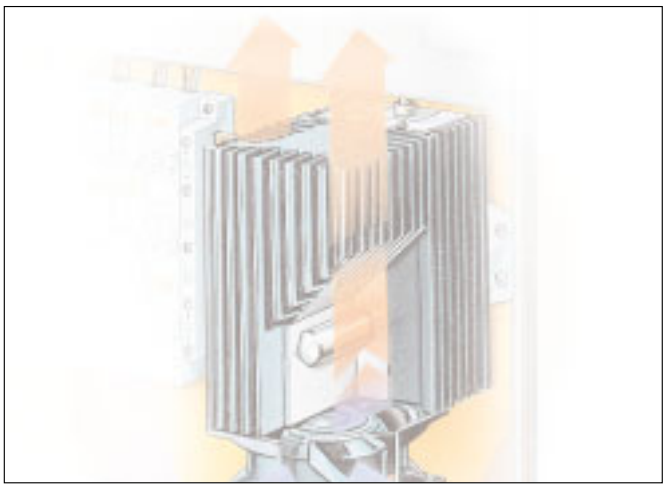

9.2

## Electrical connection

Due to the particular characteristics of the PTC thermal element, the startup current is approx. 1.8 A for around 0.5 sec. A slow pre-fuse (gL) is therefore essential.

**According to IEC 6100-4-5, a fuse is to be provided by the customer for pulse loads in excess of 1000 V. The surface temperature of the aluminium section is regulated automatically. A separate thermostat (SK 3110.000) should be connected to control the room temperature. To control the air humidity inside the enclosure, a hygrostat (SK 3118.000) may be connected upstream.**

## Benefits



The prerequisite for optimum conversion of electrical energy into thermal energy is perfect interaction between the thermal output, surface temperature and ambient temperature.

### Conventional resistor heaters

The surface temperature is limited via an additional safety thermostat. As a result, the heater is forever cutting in and out, which means that the continuous thermal output actually produced is low.

### Rittal heaters with PTC technology

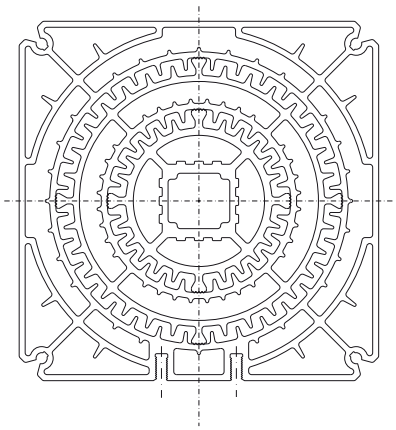
Unlike conventional resistance heaters, in thermistors (PTCs), power consumption automatically decreases as the intrinsic temperature rises. The advantages of this dynamic output behaviour are as follows:

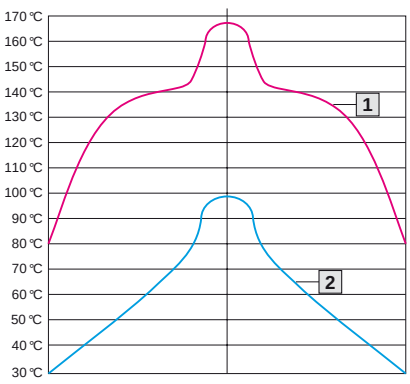
- **Limitation of surface temperature**
  without additional temperature protection devices
- **Self-regulation**
  allows direct adaptation to the ambient temperature. In other words, as the enclosure internal temperature falls, the thermal output rises (refer to performance diagrams on the Internet)
- **Consistent thermal output**
  across a broad voltage range (e.g. 110 to 240 V AC/DC).
- **Special voltages**
  possible in the low voltage range (e.g. 12 V, 24 V)
- **Long service life**
- **Compact, vibration-free mechanical structure**
- **No risk of fire in the event of a malfunction**
  due to incandescent components

### Benefits in brief !

- **Useful cooling output from 10 to 1000 watts**
- **Self-regulating PTC technology**
- **Quick-assembly system**








1 Temperature variation without fan

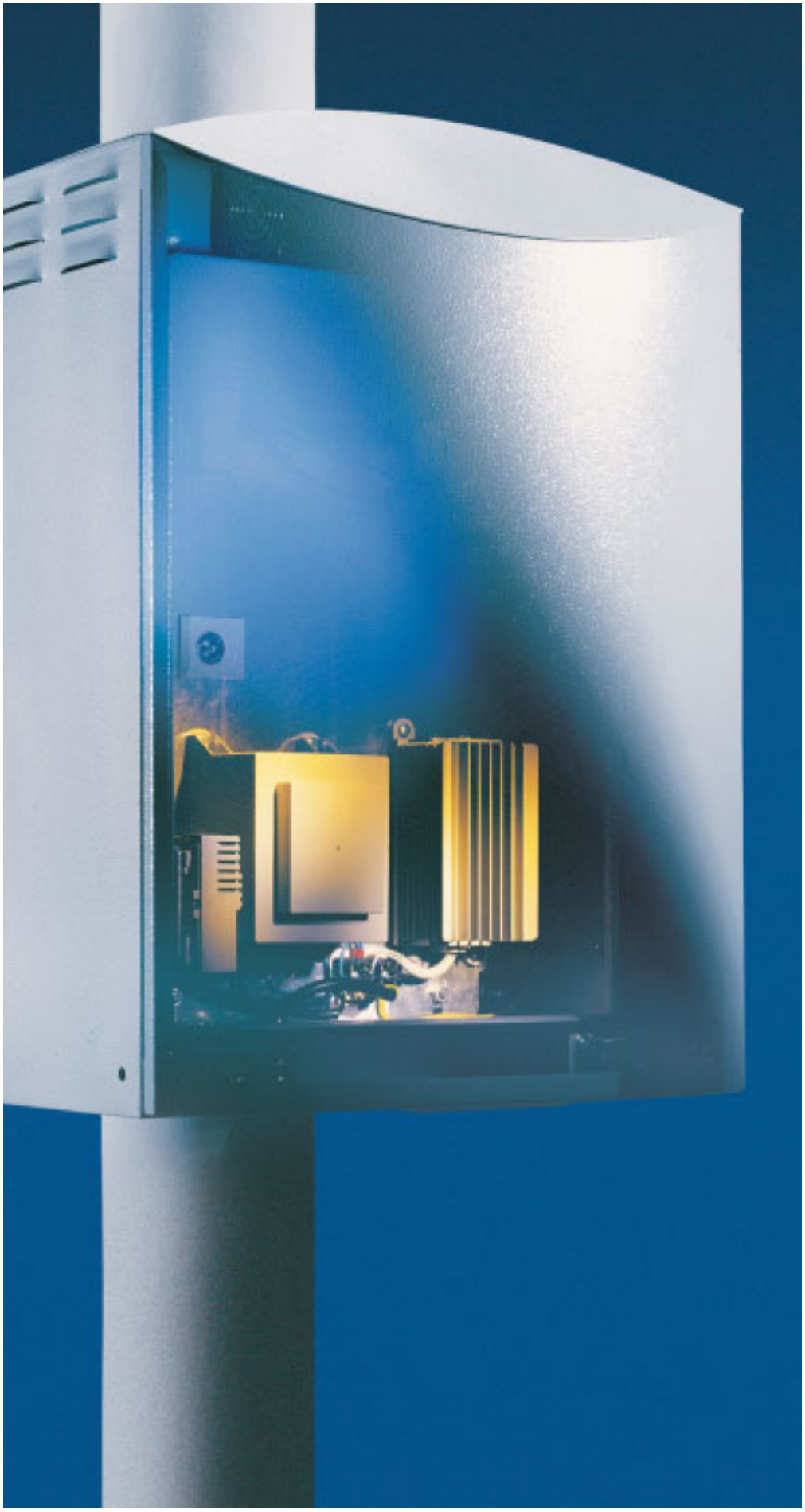
2 Temperature variation with fan

Temperature variation through the aluminium section (Tu = 20°C) as illustrated by the example of heater SK 3102.000

### Important

- For the correct temperature and to avoid condensation, use a thermostat or hygrostat – see page 84
- Heaters should always be installed in an upright position. Leave a distance of 50 mm at the top and bottom to allow convection
- The thermal output is increased with fans
- Heat is distributed evenly in large enclosures by using several low-output heaters

**Calculation formulae, see page 31 or refer to our website: www.rittal.com**



# Climate control tailored to enclosures

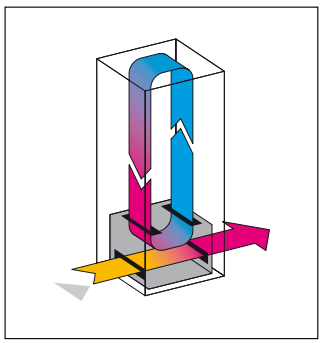
Rack-mounted cooling units and fans facilitate direct cooling of electronics by mounting in the 482.6 mm (19˝) level. Other components are also used for optimum routing of cold air inside the enclosure.

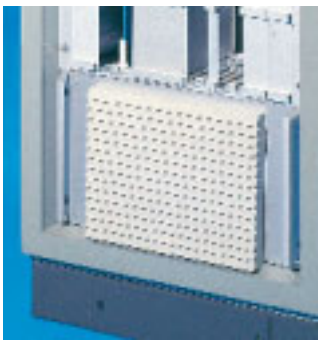
## Rack-mounted climate control

All rack-mounted climate control components are mounted on the 482.6 mm (19˝) mounting level for subracks. Because they are positioned directly below the electronic components, effective cooling and the avoidance of hotspots are guaranteed.

**Benefits:**
- Rapid installation on 482.6 mm (19˝) mounting levels
- Direct, effective dissipation of heat loss, thanks to positioning beneath the assemblies
- No externally mounted equipment to disrupt the aesthetic appearance of the enclosure

### Rack-mounted cooling units
- Useful cooling output 1000 W, 6 U
- The temperature inside the enclosure may be cooled to below the ambient temperature.
- Heated air is drawn in, cooled, and blown beneath the rack-mounted electronics to be cooled.
- Simple mounting on the 482.6 mm (19˝) level in the lower section of the enclosure.
- Sealed enclosures require a door cut-out for the external air circuit.
- With open enclosures, a fully equipped front is essential.





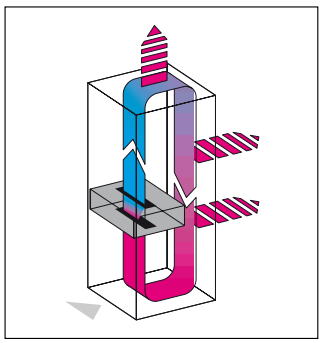
### Rack-mounted fan
- Air throughput 320/480 $m^3$/h, 1 U
- Direct ventilation of the subracks prevents hotspots and heat accumulation.
- The fan units (24 V DC, 115 – 230 V AC) are also available with integral speed control and fault evaluation.

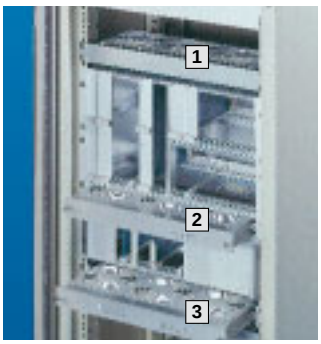
1 Mounting directly on the 482.6 mm (19˝) level

### Rack-mounted Vario fan with guide frame
- The rack-mounted fan slides like a drawer.
- Connectors on the rear ensure immediate contact.

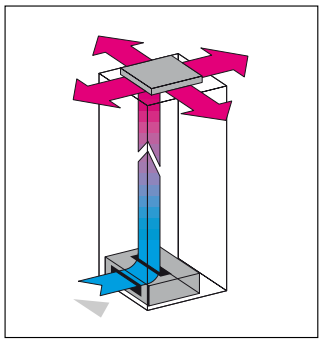
2 Installation directly in the subrack

3 Installation via two mounting brackets on the 482.6 mm (19˝) mounting level






### Centrifugal fan
- 320 $m^3$/h air throughput, 2 U
- The high air throughput means that Rittal centrifugal fans are capable of dissipating large heat losses from the enclosure.
- The ambient air is drawn in via the front grille and conveyed upwards.
- The minimal noise generation of 52 dB creates a pleasant working environment.



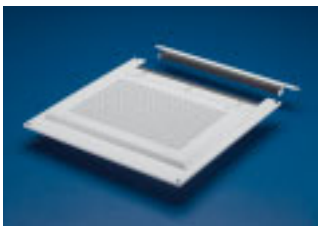
## Ventilation systems

Ready-to-use, wired modules equipped with fans for numerous Rittal enclosure system platforms offer effective air throughput and minimal assembly work.
Fan roofs, fan cross members for server enclosures (door installation), internal fan mounting panels and enclosure internal fans are all available.

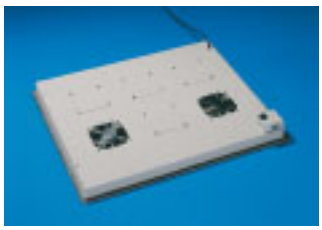
**Benefits:**
- Fast assembly
- Targeted air routing to avoid hotspots
- Perfect system integration

## Fans for integration into the roof

**For all enclosures:**
**Roof-mounted fans, passive or active**
May be integrated into any enclosure roof area with suitable dimensions for the mounting cut-out.



**For TS 8, FR(i):**
**Fan roof, modular, two-piece**
In exchange for the existing roof plate. Fan and cable entry are pre-integrated.



**For TS 8:**
**Fan mounting plate**
Installation in the enclosure in conjunction with spacer bolts or the vented roof plate for cable entry.

## Air baffle systems

**For TS 8:**
**Internal fan mounting panel**
Twin-walled side panel for targeted air routing.

**For TS 8:**
**Air baffle system**
Cold air from the hollow base is routed to the twin-walled door via an air routing nozzle and distributed in a targeted manner.
Further information may be found in Catalogue 31, page 648.

**For TS 8:**
**Enclosure internal fan**
Supports active climate control components and thereby selectively avoids hotspots.

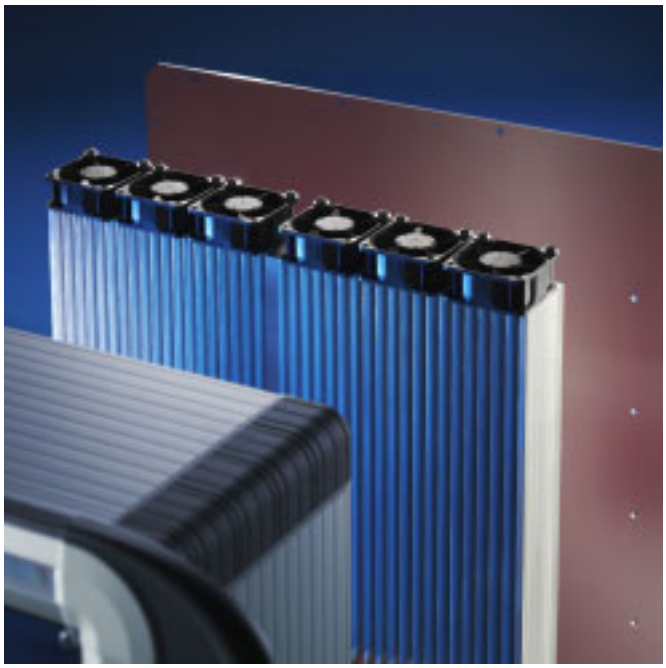
## Air baffle systems

**For TS 8:**
**Fan cross-members for server enclosures**
Specifically for installation in the tubular door frame of perforated doors.

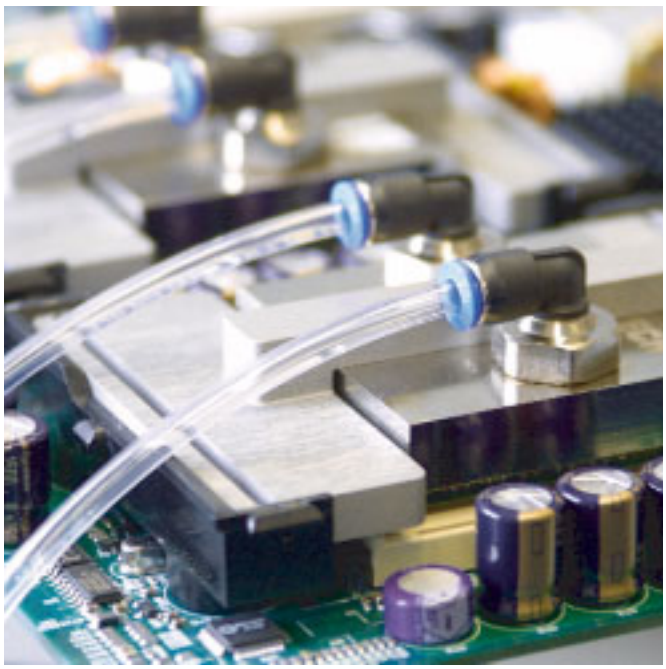
# Liquid cooling systems

Liquid cooling is silent, as well as being 1,000 times more efficient than heat dissipation via air. With this in mind, Rittal offers a range of very innovative and highly effective liquid cooling concepts for industry and IT.

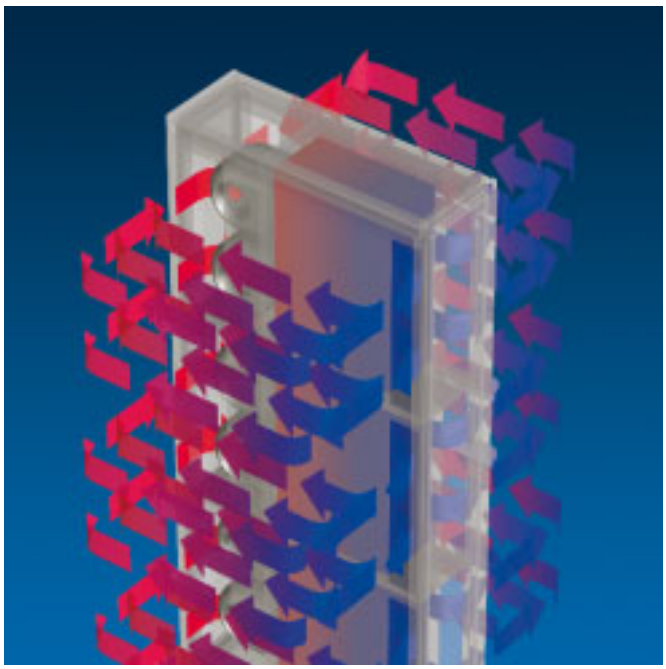
**Air/water heat exchanger –** the classic liquid cooling option for extremely heat and dust-laden ambient conditions. Dissipation of high heat loads without putting thermal pressure on the ambient air.



**Rittal DCP – Direct Cooling Package** – Optimum cooling of performance electronics inside the enclosure via liquid-cooled mounting plate, with or without fan. The protection category is not impaired.

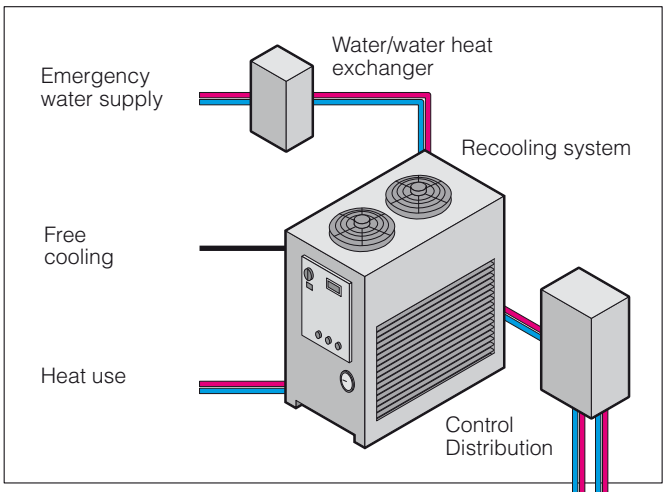


**Power Cooling System PCS –** for high performance in every rack. PCS offers the electronic performance of tomorrow, today. Distributor system and cooling of CPUs, power packs and disk drives directly at the area where heat is generated.



**Liquid Cooling Package LCP –** Useful cooling outputs up to 40 kW for the temperature-neutral expansion of data centres. Bayable cooling modules with horizontal cold air inlet tailored to the server.

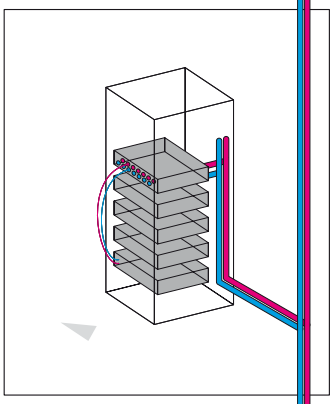
## Applications




Modular climate control concepts – to your specific requirements!

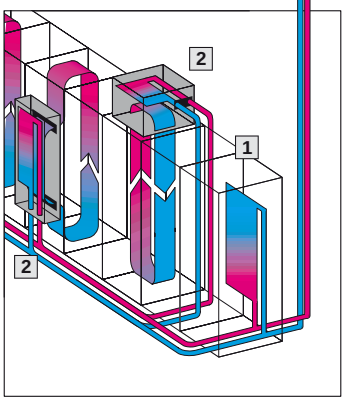
Rittal solves the problem of climate control for high heat losses per rack with liquid cooling components. Extremely high heat loads are dissipated from the enclosures, IT and server racks via air/water heat exchangers.

Additionally, data centres may be extended in a temperature-neutral way.



### PCS Power Cooling Systems

Direct cooling of electronic components (CPUs, power packs, hard disk drives etc.) in blade servers and other high-performance systems via a cooling circuit distributor.

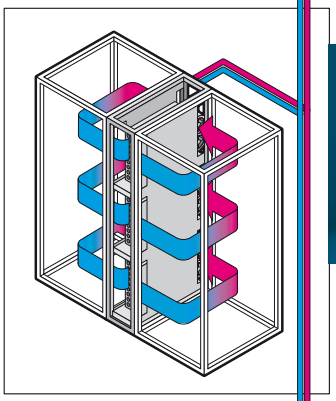



### 1 DCP Direct Cooling Package

The liquid-cooled partial mounting plate for direct cooling of frequency converters and other performance electronics.

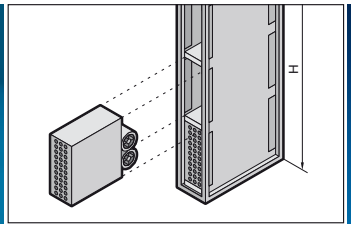
### 2 Air/water heat exchanger

Dissipates high heat losses from the enclosure.



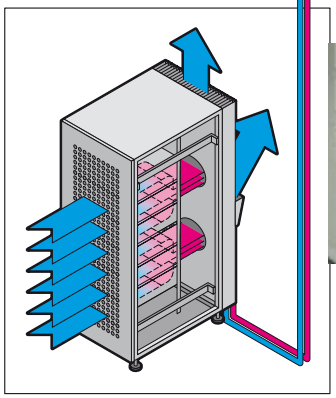
### LCP Standard/LCP Plus

**Bayable with TS 8 server racks**
As the height and depth are identical, it may be bayed either in the middle of an enclosure suite or at the end, for added assembly and servicefriendliness.




**Up to 40 kW useful cooling output**
The useful cooling output is achieved with a modular configuration (1 – 3 modules) or with the complete LCP Plus systems. Active condensate management supports inlet temperatures from +6°C to +20°C.

**Safe insertion, simple assembly**
The separation of cooling and rack prevents water from penetrating the server rack. A recooling system supplies the required cooling fluid.



### LCP Extend

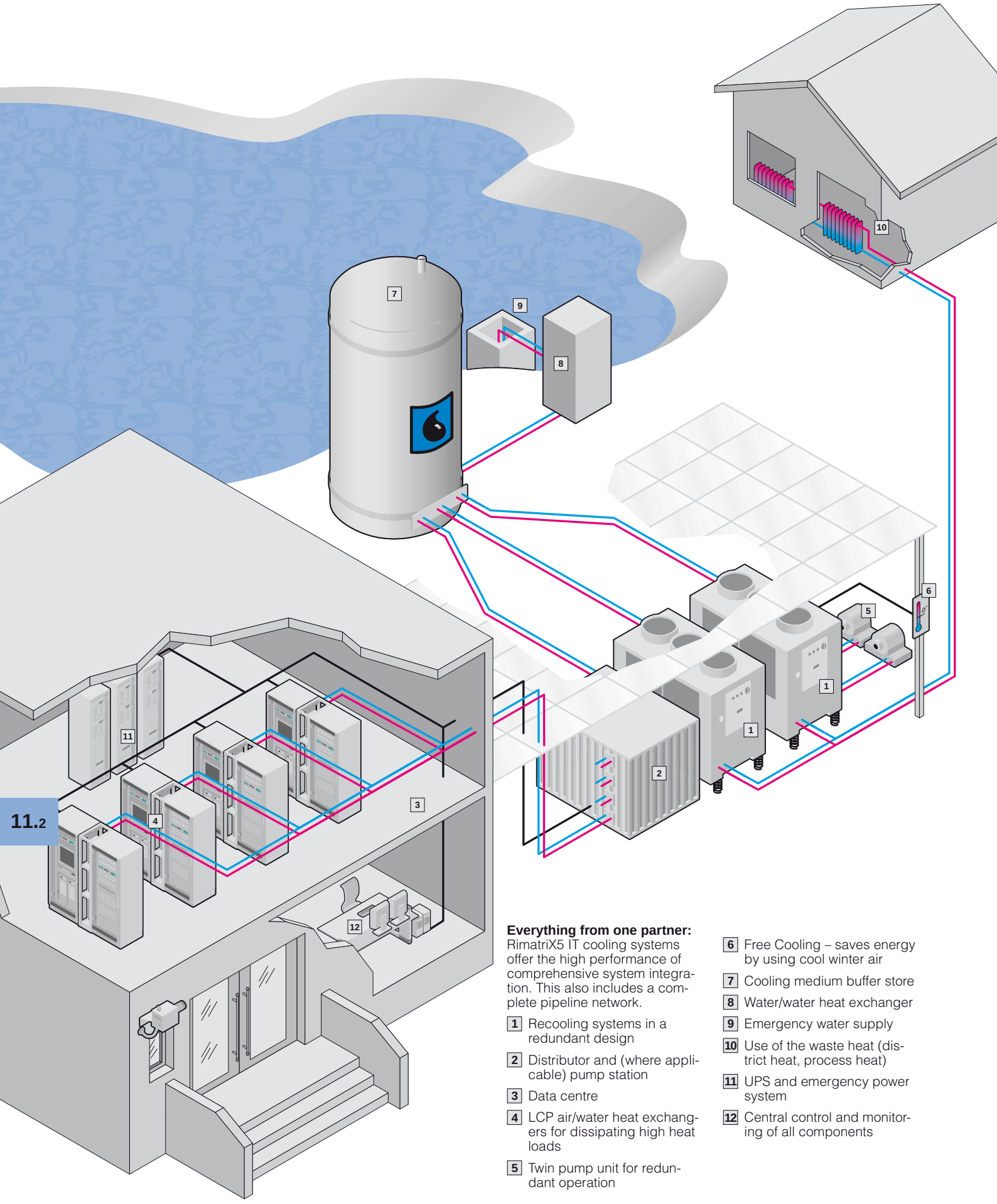
**Installation while operational**
Air/water heat exchanger (10 kW) to support climate control of the room. For Rittal racks, the relevant door is preconfigured in the factory and exchanged on site.

**Suitable for use on any surface**
The stand-alone unit may be fitted onto any suitably sized rear door (including other brands).

**Water connection variants**
Water connection either at the bottom or top. Connection to the existing cooling circuit (optionally via water/water heat exchanger) or to recooling systems.

# Liquid cooling systems

## Combined in a system with recooling systems and monitoring




11.2

**Everything from one partner:**
RimatriX5 IT cooling systems offer the high performance of comprehensive system integration. This also includes a complete pipeline network.

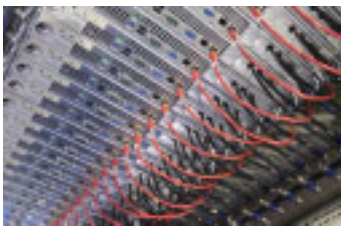
1. Recooling systems in a redundant design
2. Distributor and (where applicable) pump station
3. Data centre
4. LCP air/water heat exchangers for dissipating high heat loads
5. Twin pump unit for redundant operation
6. Free Cooling – saves energy by using cool winter air
7. Cooling medium buffer store
8. Water/water heat exchanger
9. Emergency water supply
10. Use of the waste heat (district heat, process heat)
11. UPS and emergency power system
12. Central control and monitoring of all components

## Combined in a system with recooling systems and monitoring

### Temperature-neutral server cooling

**Power Cooling System PCS**
Direct liquid cooling of high-performance CPUs and other components.
Central recooling systems supply all liquid cooling units.

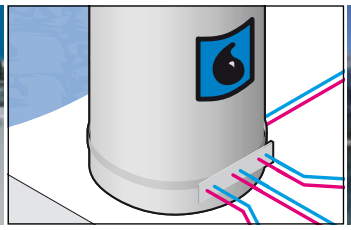
**Rising mains**
Central, monitored liquid logistics integrated into the enclosure.



**High performance**
High-performance cooling outputs can be supplied on a project basis on request.

### Central recooling system – Effective and safe

**Reliability through redundancy**
Two recooling systems with a twin pump unit ensure reliable availability of the cooling medium.

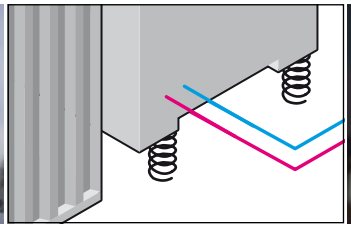


**Additional buffer store**
Compensates for varying cooling requirements and brief failures in the cooling system.

**Emergency water supply**
Full availability of the data centre – even in the event of an emergency – is guaranteed by this additional back-up. A water/water heat exchanger ensures separation of the systems.

**Reduction of water volumes in the server room**
Water/water heat exchanger as an alternative to recooling systems or for secondary incorporation into an existing cold water network.

**Energy-efficient: Free Cooling**
The plentiful supply of cold winter air is used to lower the temperature of the cooling medium.



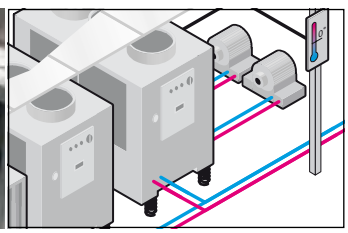
**Vibration damping**
Precision manufacturing techniques are not impaired by the inherent vibrations of the recooling systems.

**Heat use**
Waste heat from the recooling systems may be reused by feeding into a district or process heating network.

### RiWatch IT – Complete monitoring and security

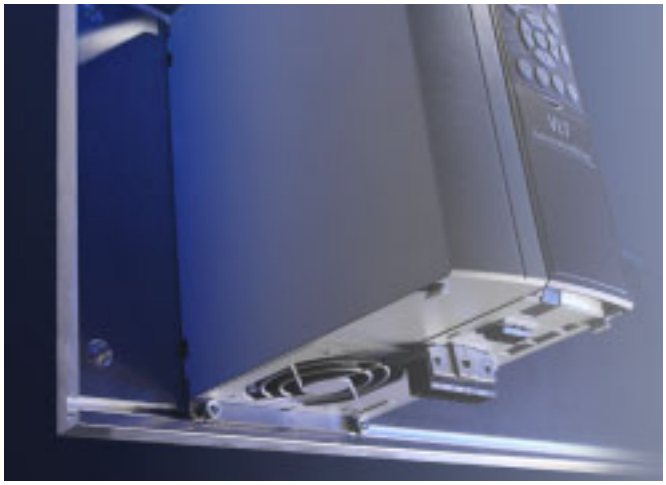
**Central system control**
Rittal CMC-TC – RiWatch IT for functional and security management of all IT and cooling components.

**Security in the data centre**
Access control, power supply, temperature – Every factor affecting IT availability is monitored.



**Reliable cooling**
The control and monitoring of all climate components ensures reliable, precise cooling.

## DCP – Direct Cooling Package/application, assembly



**Applications:** Power electronic components can be cooled particularly effectively using the liquid cooled DCP mounting plate. Heat losses are cleverly dissipated from the enclosure or housing without compromising the high enclosure protection category in any way. Furthermore, liquid cooling is both quiet and 1,000 times more efficient than heat dissipation via air.

The Rittal DCP Cold Plate has received type-tested certification from the TÜV inspection authority and is approved for pressures up to 10 bar.

### Assembly

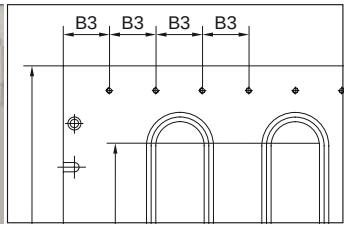
**Attachment directly in the T-slot**
Direct and fast mounting using sliding nuts for components with suitable dimensions. Direct earthing or equipotential bonding points are provided on the Cold Plate.

**Attachment with variable clamping system**
Supports fast mechanical installation without the need for drilling, independently of the original attachment points on the component.

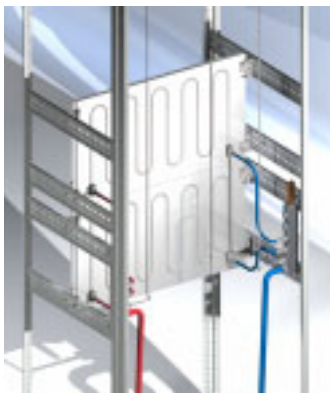
For use with a wide range of models and makes.

**Attachment with retainers**
Frequency converters with dimensions marginally smaller than the T slot spacing can be secured with special retainers.

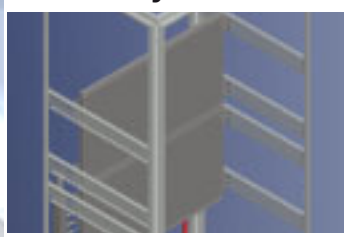
**Attachment with tapped holes**
Frequency converters can be mounted at any position over the whole surface by drilling tapped holes up to max. 12 mm in depth.




Manufacturer or customer-specific Cold Plates may be supplied on a project-related basis on request.

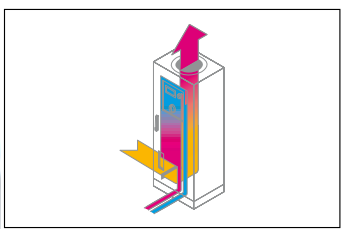


### Assembly/water connection system



Height and depth-variable mounting positions are facilitated by the system punchings of the TS 8 profiles in conjunction with punched section with mounting flange 17 x 73 mm (for the outer mounting level).

Fluid distributor with fast-action vent valve



Recooling system in the room or outside

## Rittal DCP – CoolingUnit

**Application:**
The CoolingUnit is available in two variants. As a stand-alone unit with press-fitted cooler tubes, or as an add-on in conjunction with a Rittal Cold Plate. The optional housing for the cooler ensures even more efficient air routing and thus reliable cooling of the air inside the enclosure.

**Function principle:**
The warm air inside the enclosure is drawn up by a powerful radial fan and passed through the cooler.

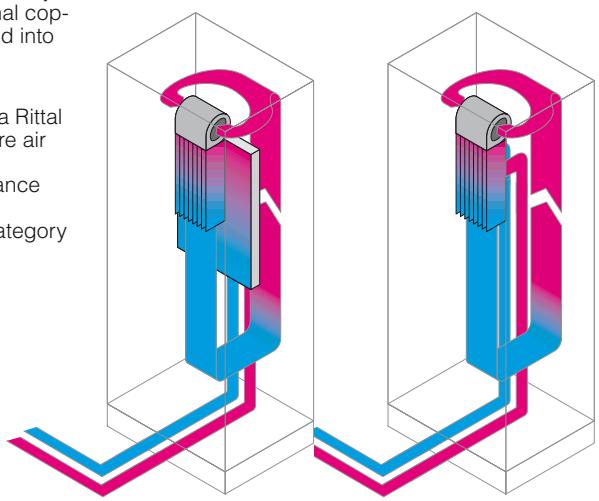
The unit can be operated either indirectly, i.e. mounted on a Rittal Cold Plate, or as a fully autonomous system with its own cooling water circulation. The latter supports direct mounting on the mounting plate in the immediate vicinity of major heat loss sources. In this variant, additional copper or stainless steel tubes are press-fitted into the cooler.

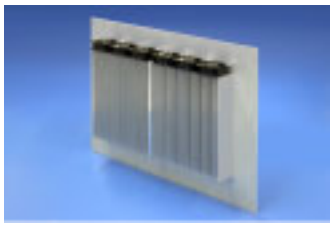
**Benefits:**
- Direct cooling of power electronics on a Rittal Cold Plate and lowering of the enclosure air temperature
- Decentralised cooling of high-performance power electronics
- No change to the existing protection category of the enclosure

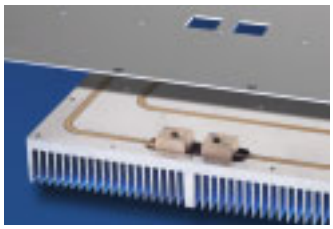
Further technical information is available at www.rittal.de/dcp.

**Installation:**

**Add-on** **Stand-alone**







## Rittal DCP – PanelCooling

**Application:**
This integrated PanelCooling solution was developed by Rittal for optimum, space-saving cooling of operating housings. Heat losses of approx. 250 – 300 W can be dissipated without the need for external add-ons. The high protection category of the enclosure is retained, thanks to the fluid connection at the rear of the panel.

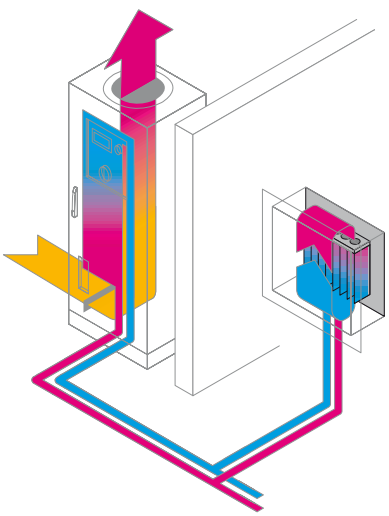
**Function principle:**
The fan unit with six individual fans ensures optimum air circulation at the cooler for efficient dissipation of the heat losses arising in the housing. The unit can be connected either to an existing coolant circuit or else to an external recooling system.

**Benefits:**
- Maximum performance despite minimal space requirements
- No reduction of the original protection category
- No external add-ons necessary

Operating housing cooling for Comfort Panels and the like, also suitable for use in special enclosures such as stainless steel enclosures for the food industry.
Cooling units may be ordered for heat losses of up to 300 W on a project-specific basis.

Further technical information is available at www.rittal.de/dcp.

**Installation:**



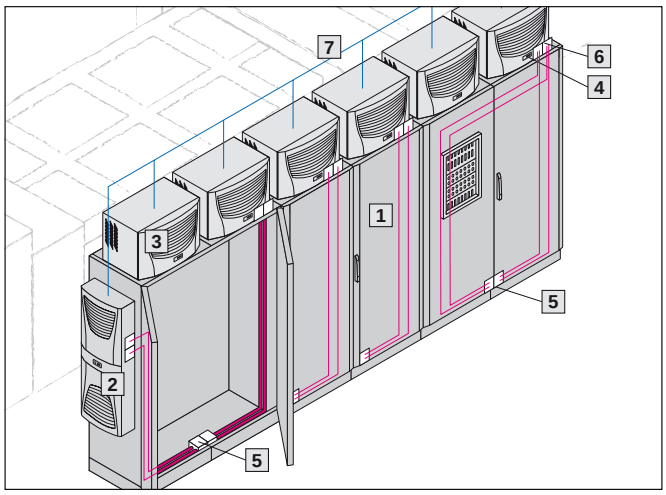
# Monitoring

All the relevant parameters for the function and cooling output of the climate control components are available on the control desk for monitoring and control purposes.

## Master/slave operation

In open bayed enclosure systems which are not separate from one another, cooling units and air/water heat exchangers with Comfort control should always be used. These may be placed in master/slave mode via bus cable **SK 3124.100**:

- Simultaneous activation and deactivation of the devices
- Parallel fault and door limit switch function
- Even temperature distribution across all sections of the enclosure




1 Control cabinets
2 Wall-mounted unit
3 Roof-mounted unit
4 Comfort controller
5 Door limit switch
6 Connection terminals 1 and 2 of the cooling unit
7 Master/slave unit

## Interface board

The new interface board **(SK 3124.200)** is an extension for TopTherm cooling units and air/water heat exchangers with Comfort controller; see page 41. In this way it is possible, e.g. to monitor a master/slave combination of up to 10 cooling units. Control is achieved via standardised interfaces RS 232 (DB9) or RS 485, a PLC interface. RS 422 (RJ 45 jack) is the connection to the Rittal CMC-TC. Remote monitoring via TCP-IP, graphical interfaces for operation, evaluation and control, documentation, and connection to additional sensors for access control facilitates monitoring.

The extension card is built into a 1 U plastic housing. A voltage supply of 24 V (DC) is required. This can be supplied from the CMC-TC via long-range power pack or externally via a Kycon connector.

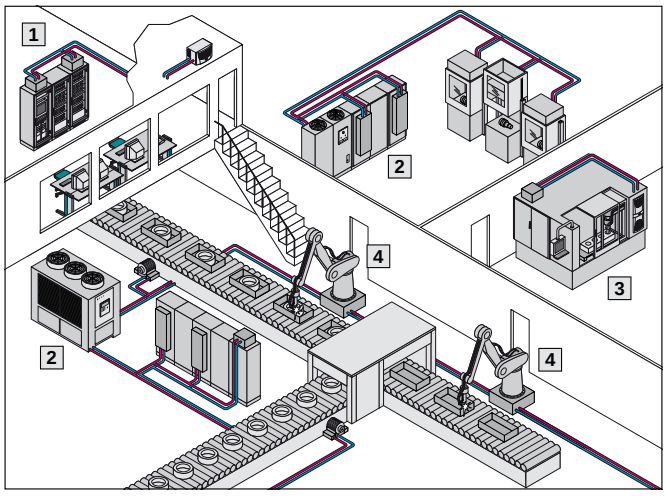
Further information may be found in our assembly and operating instructions, at
**www.rittal.com –> Products –> Product search –> SK 3124.200**

**Warnings and alarms from the interface board**

- Interior temperaure too high
- Icing
- High-pressure sensor
- Leakage
- Condenser/fan defect
- Evaporator coil/fan defect
- Compressor defect
- Sensor failure, condenser temperature
- Sensor failure, ambient temperature
- Sensor failure, icing sensor
- Sensor failure, condensate level
- Sensor failure, internal temperature
- Phase missing or incorrect
- EEPROM defect

12.1

## Application example: Master/slave operation and interface board




1 Control point/server room
2 Recooling system
3 Machining centre
4 Welding robot

## Connection example: Master/slave operation

**with bus cable and interface board**

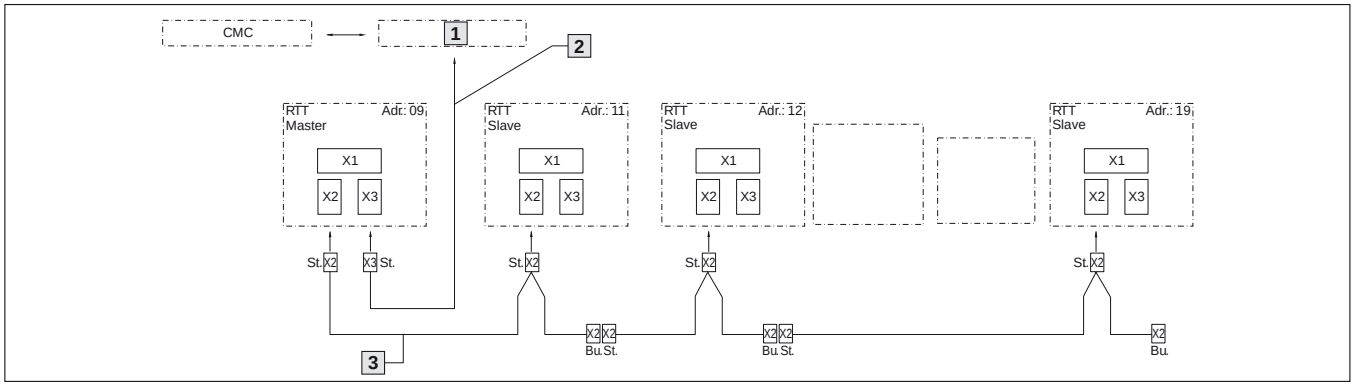
1 Serial interface board, Model No.: SK 3124.200

2 Serial interface cable

3 Master/slave BUS cable, Model No.: SK 3124.100

RTT = Rittal TopTherm cooling unit/ Air/water heat exchangers
X1 = Supply connection/door limit switch/alarms
X2 = Master/slave connection SUB-D 9-pole
X3 = Serial interface SUB-D 9-pole
St. = SUB-D connector 9-pole
Bu. = SUB-D jack 9-pole

**Description:**
The address of the master depends on the number of attached slave units (09 = master with 9 slave units). The address of a slave device always begins with a 1. The second number represents the actual address. Up to a maximum of 9 slave units may be operated with one master unit, whereby any unit may be a master. The maximum overall length of all connected units is 50 m. single-phase and 3-phase units may be connected.




## Notes on connecting cooling units and air/water heat exchangers in the master/slave combination

Only one unit may be configured as master, and the address ID must match the number of slave units. All slave units must have different addresses, and the addresses must be in ascending order without any gaps in between.

If changes are made to the configuration of the master, please proceed as follows:

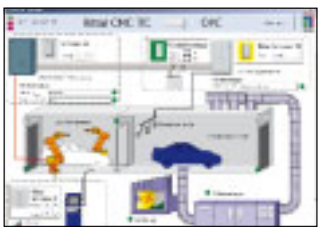
1. Disconnect any existing connections between the RTT I/O unit and the PU
   – Timeout on the PU
2. Confirmation on the PU
   – Unit has been removed
3. Make the required changes to the master
4. Make the connection between the RTT I/O unit and the PU
   – Message on the PU "Unit found"
5. Wait 60 s then confirm
   – RTT I/O unit is correctly displayed with all its slaves in the Web.

**Configuration settings on the cooling unit master regarding the number of slaves must only be made if there is no supply voltage at the RTT I/O unit, neither from the PU nor externally.**

## SNMP-OPC server

For all applications in industrial automation technology and building automation, with OLE for process control (OPC) “OLE: (Object Linking and Embedding)” provides the ideal interface between your control desk software and the CMC-TC system. Software available on request.
**www.cmc-tc.com**

**Note:**
Further information can be found on the Internet at:
**www.obermeier-software.de**
or by sending an e-mail enquiry to
**info@obermeier-software.de**



# Accessories

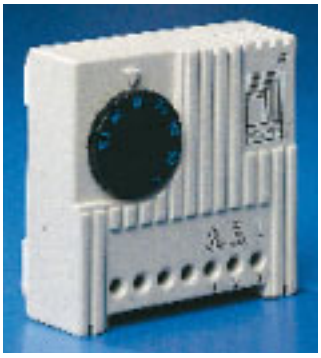
## Regulation/control

**Digital temperature display/thermostat: SK 3114.100/.115/.024**
For installing on the enclosure door or wall and in a cooling unit or heat exchanger.

**Speed control**
Temperature-dependent speed control to minimise noise and save energy in part-load operation.

**Thermostat: SK 3110.000**
Especially suitable for controlling fan-and-filter units, heaters and heat exchangers, this thermostat can also be used as a signal generator for monitoring the enclosure internal temperature.

**Hygrostat: SK 3118.000**
The hygrostat switches on the heater and/or fan when a preset relative humidity in the enclosure is exceeded. In this way, the relative humidity is raised above the dew point, and condensation on assemblies or on electronic components is avoided.



**For more accessories, see Catalogue 31, from page 658.**

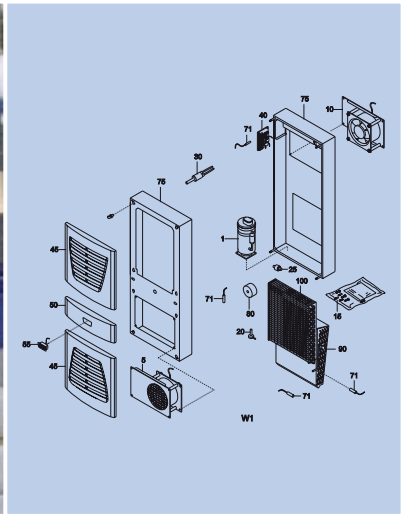
# Service

**International climate control service**

A central point of contact, decentralised implementation, short response times – this is the successful concept behind our **International Climate Service team.**

High-tech system climate control must offer a permanently high level of reliability in enclosure cooling as well as in machine and process cooling. For this reason, we aim to achieve a **maximum global response time of 48 hours**. We offer this ambitious after-sales service with 95 service partners in Germany and 57 partners in our international service network. In this way, Rittal is once again leading the way in comprehensive customer service.

Be it commissioning, maintenance and service work or the supply of spare parts – the International Climate Service offers prompt, comprehensive, expert coordination of the task in hand.



**Hotline support: Always on hand, wherever you happen to be**

Our service team are able to clarify many of your queries on the telephone, or can initiate the required action quickly and unbureaucratically.

**International climate control service**
**+49(0)2772 505-1855**
**e-mail: rsi@rittal-service.com**

**Rittal Climate Service at 150 locations worldwide**

From A for Argentina, to Z for Zaire – the International Climate Service from Rittal is on hand to deal with any query.

**Our service – Your peace of mind**

It goes without saying that the **first-time commissioning** of recooling units is one of the services we offer.
Take advantage of our **maintenance agreements.**
The maintenance-friendly technology means that a high degree of operational reliability is achieved with minimal service input.
**Need a repair service**, either on-site or in the central workshop?
Or super-fast replacement units while repairs are being carried out? We will take care of it.
Centrally coordinated, decentrally warehoused – our **spare parts service** will organise the fastest route to you.

## Rittal climate checks

# Service packages for every aspect of enclosure climate control

Load tests as the optimum basis for planning.

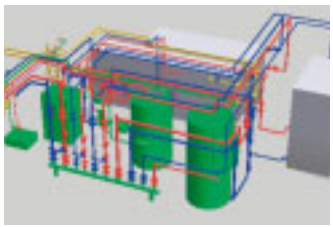
## Load test

482.6 mm (19˝) slide-in equipment which simulates the thermodynamic response of servers allows you to determine in advance whether your cooling system is adequate for any planned extensions. Furthermore, after installing the LCP family, the cooling response can be tested directly, without the presence of a server.

With sensor technology for 3D analyses.

## Intelligent wireless sensor technology

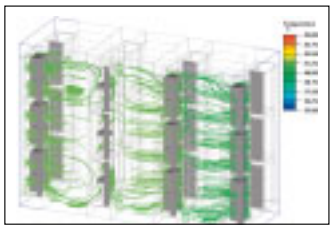
Sensors the size of a button record the temperature and humidity at specified locations in the rack. The location and time-dependent readings are extracted and displayed. The result is a 3D analysis of the data centre's cooling response.



Perfect dimensioning of pipe networks

## Piping network calculation

The Rittal specialists use a software package to design and dimension the pipe networks of liquid cooling systems, with due regard for the architectural conditions. The specifications thereby obtained allow the local installation engineer to start work immediately.



Forward planning with CFD.

## CFD (Computational Fluid Dynamics)

A 3D computer simulation is used to visualise the thermodynamic response of the planned data centre with server racks and climate control system. Predicting the temperature, speed, pressure and hence flow conditions in the data centre facilitates fast reaction times.

Localisation of hotspots via thermography.

## Thermography

Using a thermal imaging camera which illustrates the temperature conditions (surface) inside the data centre with colour coding, hotspots can be located and eliminated via suitable means.

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# System climate control range Catalogue 31 and Innovations 2005/2006

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